Configuration Guide

HP StorageWorks Enterprise Virtual Array Hardware

Fourth Edition
(September 2004)

AA-RS28D-TE

This guide describes the various hardware configurations used for the HP StorageWorks Enterprise Virtual Array. It discusses the quantity of various hardware components in each configuration and how the hardware components are connected to each other. The expansion of existing racks is also discussed.

For the latest version of this document and other storage system documentation, visit the HP storage web site at: http://welcome.hp.com/country/us/eng/prodserv/storage.html.

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About this Guide

This hardware configuration guide provides information to help you:

- Learn about the Enterprise Virtual Array hardware components.
- Understand the supported storage rack configurations.
- Expand an Enterprise Virtual Array with drive enclosures.
- Understand the supported copper cable configurations.
- Convert an Enterprise Virtual Array v1.0 storage rack configuration into an Enterprise Virtual Array v2.0 storage rack configuration.

About this Guide topics include:

Overview

This section covers the following topics:

Intended audience

This book is intended for use by Enterprise Virtual Array administrators who are experienced with the following:

- Working with copper cables.
- Working with Fibre Channel loop switches.
- Maintaining and operating Storage Area Networks (SANs).

Related documentation

Additional documentation is available from the HP web site at: http://welcome.hp.com/country/us/eng/prodserv/storage.html.

Conventions

Conventions consist of the following:

- Document conventions
- Text symbols
- Equipment symbols

Document conventions

The document conventions included in Table 1 apply in most cases.

Table 1. Document Conventions

Element	Conventions
Cross-reference links	Blue text: Figure 1
Key and field names, menu items, buttons, and dialog box titles	**Bold**
File names, application names, and text emphasis	*Italics*
User input, command and directory names, and system responses (output and messages)	`Monospace font` COMMAND NAMES are uppercase monospace font unless they are case sensitive
Variables	*`<monospace, italic font>`*
Web site addresses	Blue, underlined sans serif font text: http://www.hp.com

Text symbols

The following symbols may be found in the text of this guide. They have the following meanings.

Warning

Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or loss of life.

Caution

Text set off in this manner indicates that failure to follow directions could result in damage to equipment or data.

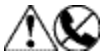
Note

Text set off in this manner presents commentary, sidelights, or interesting points of information.

Equipment symbols

The following equipment symbols may be found on hardware to which this guide pertains. They have the following meanings:

Any surface or area of the equipment marked with these symbols indicates the presence of electrical shock hazards. Enclosed area contains no operator serviceable parts.
WARNING: To reduce the risk of injury from electrical shock hazards, do not open this enclosure.



Any RJ-45 receptacle marked with these symbols indicates a Network Interface Connection.
WARNING: To reduce the risk of electrical shock, fire, or damage to the equipment, do not plug telephone or telecommunications connectors into this receptacle

Any surface or area of the equipment marked with these symbols indicates the presence of a hot surface or hot component. If this surface is contacted, the potential for injury exists.
WARNING: To reduce the risk of injury from a hot component, allow the surface to cool before touching.

Power Supplies or Systems marked with these symbols indicate the equipment is supplied by multiple sources of power.
WARNING: To reduce the risk of injury from electrical shock, remove all power cords to completely disconnect power from the system.

Any product or assembly marked with these symbols indicates that the component exceeds the recommended weight for one individual to handle safely.
WARNING: To reduce the risk of personal INJURY or damage to the equipment, observe local occupational health and safety requirements and guidelines for manual material handling.

Rack stability

Warning

To reduce the risk of personal injury or damage to the equipment, be sure that:

- The leveling jacks are extended to the floor.
- The full weight of the rack rests on the leveling jacks.
- In single rack installations, the stabilizing feet are attached to the rack.
- In multiple rack installations, the racks are coupled. Only one rack component is extended at any time. A rack may become unstable if more than one rack component is extended for any reason.

Getting help

If you still have a question after reading this guide, contact an HP Authorized Service Representative or access our we bsite: http://www.hp.com.

HP technical support

In North America, call technical support at 1-800-354-9000, available 24 hours a day, 7 days a week.

Note

For continuous quality improvement, calls may be recorded or monitored.

Outside North America, call technical support at the nearest location. Telephone numbers for worldwide technical support are listed on the HP website under support: http://welcome.hp.com/country/us/eng/prodserv/storage.html.

Be sure to have the following information available before calling:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages
- Operating system type and revision level
- Detailed, specific questions

HP storage website

The HP website has the latest information on this product, as well as the latest drivers. Access storage at: http://welcome.hp.com/country/us/eng/prodserv/storage.html. From this website, select the appropriate product or solution.

HP authorized reseller

For the name of your nearest HP authorized reseller:

- In the United States, call 1-800-345-1518.
- In Canada, call 1-800-263-5868.
- Elsewhere, see the HP web site for locations and telephone numbers: http://www.hp.com.

Chapter 1. Enterprise Virtual Array 5000 Hardware

This chapter briefly discusses the hardware components in the Enterprise Virtual Array 5000. The following topics are discussed:

- Storage rack
- Fibre Channel Drive Enclosures
- HSV110 controllers
- Fibre Channel loop switches
- Copper cables

Storage rack

The Enterprise Virtual Array can be housed in the 42U rack. The storage rack can hold a maximum of 12 Fibre Channel drive enclosures (FC drive enclosures) and two controllers.

42U rack

The 42U rack is opal in color and 909 mm (35.8 inches) deep. The storage rack features standard 19-inch mounting rails. The 42U rack can support Enterprise Virtual Array configurations that include FC loop switches or expansion panels.

Figure 1.1 shows the front and rear views of a 42U rack.

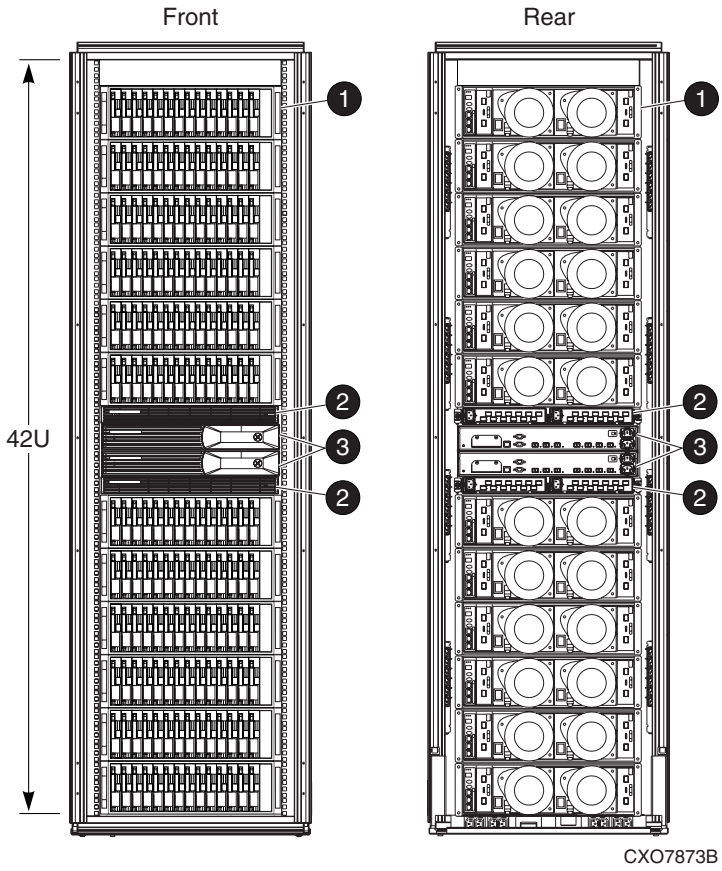


Figure 1.1. 42U rack—front and rear views

Callouts:

1. FC drive enclosure
2. FC loop switches
3. Controller pair

2C6D features

The following features are included in the 2C6D configuration:

- One storage rack
- Two controllers
- Six 14-drive bay FC drive enclosures
- Four FC loop switches
- Sixteen internal copper cables
- Seven 2-port enclosure address bus junction boxes
- Eight AC strips
- Two 0U PDUs

Note

Disks must be ordered separately.

The 2C6D configuration can contain 72 disk drives and a maximum storage capacity of 25.2 TB (Table 1.1).

Table 1.1. Maximum Storage Capacities for the 2C6D Configuration

Disk Size	Maximum Capacity
36.4 GB	3.1 TB
72.8 GB	6.1 TB
146 GB	12.3 TB
250 GB	21 TB
300 GB	25.2 TB

Note

The 2C6D configuration can be expanded to increase storage capacity. However, there is a limit to expansion; each controller pair can support a maximum of 240 disks.

Figure 1.2 shows the rear view of the 2C6D configuration.

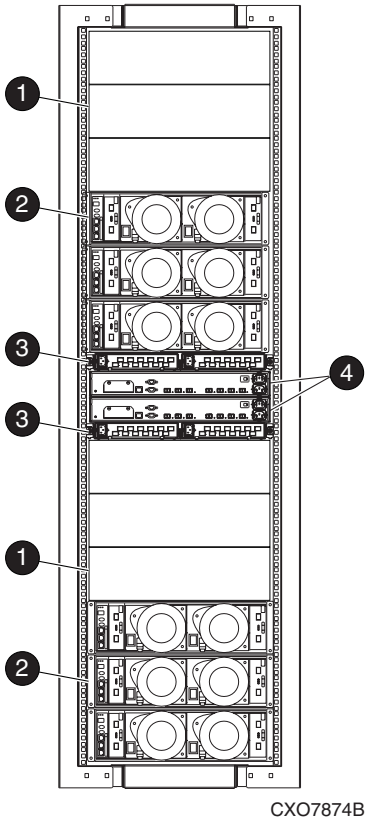


Figure 1.2. 2C6D configuration—rear view

Callouts:

1. 3U blank
2. FC drive enclosure
3. FC loop switch
4. Controller pair

2C12D features

The following features are included in the 2C12D:

- One storage rack
- Two controllers
- Twelve 14-drive bay FC drive enclosures
- Four FC loop switches
- Thirty-two internal copper cables
- Seven 2-port enclosure address bus junction boxes
- Eight AC strips
- Two 0U PDUs

Note

Disks must be ordered separately.

The 2C12D configuration can contain 168 disk drives and a maximum storage capacity of 50.4 TB (Table 1.2).

Table 1.2. Maximum Storage Capacities for the 2C12D Configuration

Disk Size	Maximum Capacity
36.4 GB	6.1 TB
72.8 GB	12.2 TB
146 GB	24.5 TB
250 GB	42 TB
300 GB	50.4 TB

Note

The 2C12D configuration can be expanded to increase storage capacity. However, there is a limit to expansion; each controller pair can support a maximum of 240 disks.

Figure 1.3 shows the 2C12D configuration.

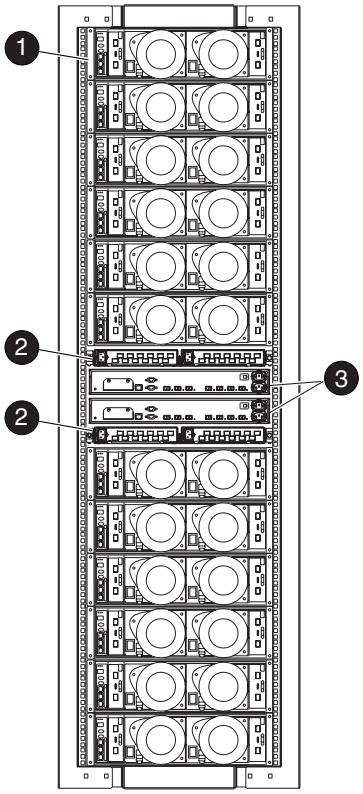


Figure 1.3. 2C12D configuration—rear view

Callouts:

1. FC drive enclosure
2. FC loop switch
3. Controller pair

8C8D features

The following features are included with the 8C8D configuration:

- One storage rack
- Eight controllers
- Eight 14-drive bay FC drive enclosures
- Thirty-two internal copper cables
- Seven 2-port enclosure address bus junction boxes
- Eight AC strips
- Two 0U PDUs

Note

Disks must be ordered separately.

The 8C8D configuration can contain 112 disk drives and a maximum storage capacity of 33.6 TB (Table 1.3).

Table 1.3. Maximum Storage Capacities for the 8C8D Configuration

Disk Size	Maximum Capacity
36.4 GB	4.1 TB
72.8 GB	8.2 TB
146 GB	16.4 TB
250 GB	28 TB
300 GB	33.6 TB

Figure 1.4 shows the 8C8D configuration.

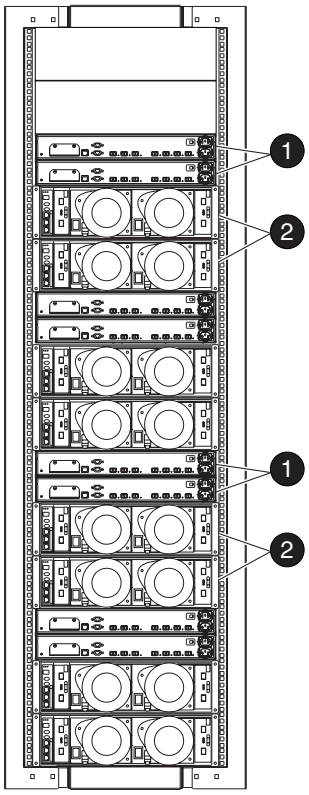


Figure 1.4. 8C8D configuration—rear view

Callouts:

1. Controller pair
2. FC drive enclosure

2C2D features

The following features are included in the 2C2D configuration:

- One 41U storage rack
- Two controllers
- Two 14-drive bay FC drive enclosures
- Eight internal copper cables
- Seven 2-port enclosure address bus junction boxes
- Eight AC strips
- Two 0U PDUs

Note

Disks must be ordered separately.

The 2C2D configuration can contain 28 disk drives and a maximum storage capacity of 8.4 TB (Table 1.4).

Table 1.4. Maximum Storage Capacities for the 2C2D

Disk Size	Maximum Capacity
36.4 GB	1.0 TB
72.8 GB	2.0 TB
146 GB	4.1 TB
250 GB	7.0 TB
300 GB	8.4 TB

You can expand the storage capacity of the 2C2D configuration by adding drive enclosures and FC loop switches to the rack.

Figure 1.5 shows the front and rear views of the 2C2D configuration.

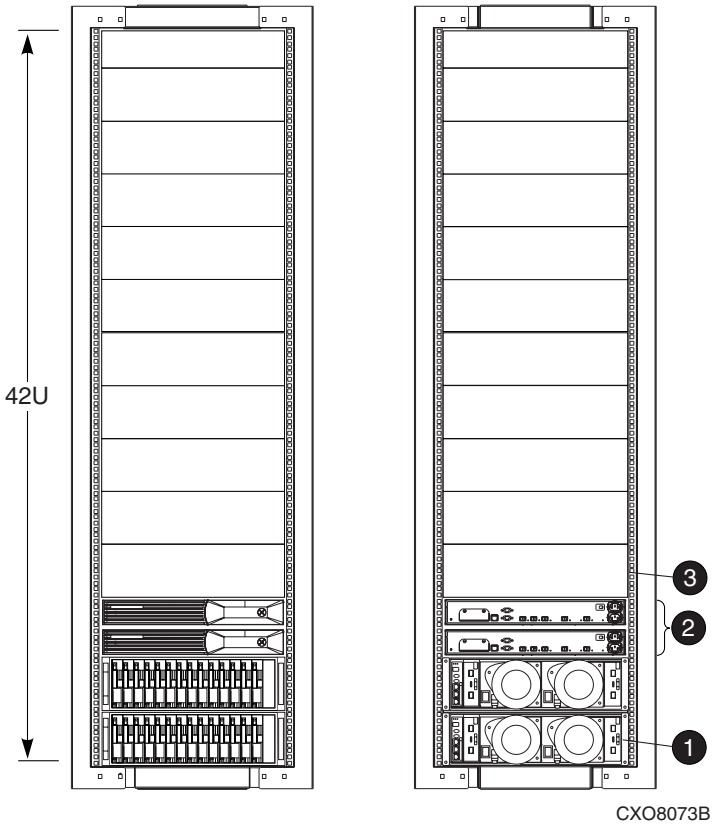


Figure 1.5. 2C2D configuration—front and rear views

Callouts:

1. FC drive enclosure
2. Controller pair
3. Blank

0C6D features

The following features are included with the 0C6D configuration:

- One storage rack
- Six 14-drive bay FC drive enclosures
- Twelve 5-meter rack-to-rack copper cables
- Six 2-port enclosure address bus junction boxes
- Eight AC strips
- Two 0U PDUs

Note

Disks must be ordered separately.

The 0C6D configuration can add 84 disk drives and a maximum storage capacity of 21.6 TB to an existing Enterprise Virtual Array (Table 1.5).

Table 1.5. Maximum Storage Capacities for the 0C6D Configuration

Disk Size	Maximum Capacity
36.4 GB	2.6 TB
72.8 GB	5.2 TB
146 GB	10.5 TB
250 GB	18 TB
300 GB	21.6 TB

Figure 1.6 shows the rear view of the 0C6D configuration.

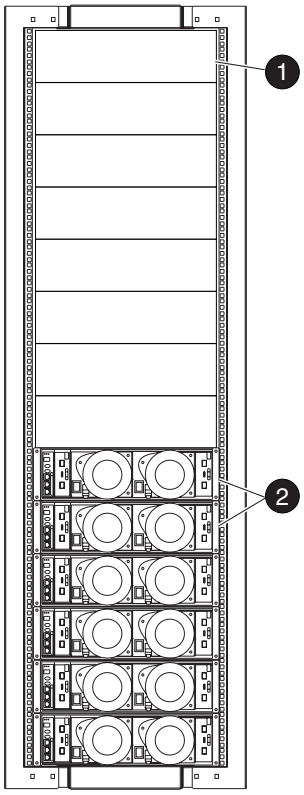


Figure 1.6. 0C6D configuration—rear view

Callouts:

1. 3U blank
2. FC drive enclosure

0C12D features

The following features are included with the 0C12D configuration:

- One storage rack
- Twelve 14-drive bay FC drive enclosures
- Twenty-four 5-meter rack-to-rack copper cables
- Six 2-port enclosure address bus junction boxes
- Eight AC strips
- Two 0U PDUs

Note

Disks must be ordered separately.

The 0C12D configuration can add 144 disk drives and a maximum storage capacity of 43.2 TB to an existing storage system (Table 1.6). Typically, this storage capacity is evenly divided between two 2C12D Enterprise storage systems. If you add the 0C12D to two 2C12Ds, the storage capacity for each 2C12D could increase to a maximum of 72 TB (240 300-GB disks).

Table 1.6. Maximum Storage Capacities for the 0C12D Configuration

Disk Size	Maximum Capacity
36.4 GB	5.2 TB
72.8 GB	10.5 TB
146 GB	21 TB
250 GB	36 TB
300 GB	43.2 TB

Figure 1.7 shows the rear view of the 0C12D configuration.

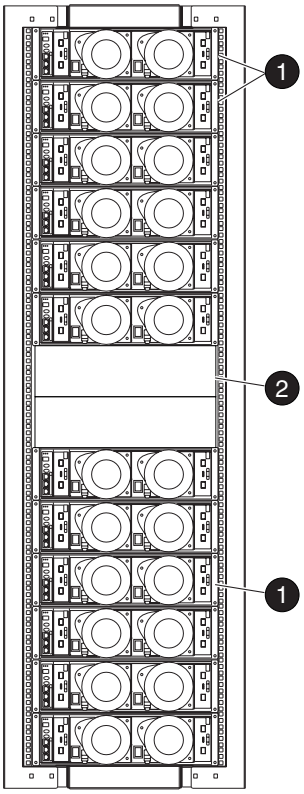


Figure 1.7. 0C12D configuration—rear view

Callouts:

1. FC drive enclosure
2. 3U blank

Fibre Channel drive enclosures

Each FC drive enclosure includes the following features:

- 3U drive enclosure
- Dual redundant, active-to-active, 2-Gbps Fibre Channel loops
- Fourteen 1-inch Fibre Channel disks per enclosure
- Dual 2-Gbps Fibre Channel I/O module—A and B
  - Enhanced fault detection
  - Single GBIC
- Dual 500-W redundant hot-plug power supplies and fans

For ease of reference, the disk drives are usually referred to by their physical location, the drive bay number.

Figure 1.8 shows the front and rear views of the FC drive enclosure and the physical location of each drive bay.

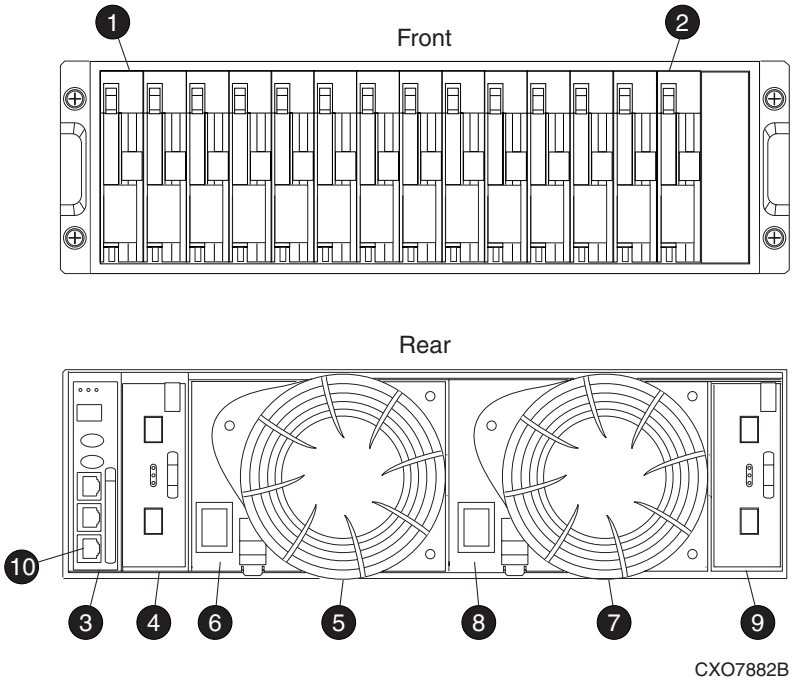


Figure 1.8. FC drive enclosure—front and rear views

Callouts:

1. Drive bay 1
2. Drive bay 14
3. EMU
4. I/O module B
5. Blower 1

6. Power supply 1
7. Blower 2
8. Power supply 2
9. I/O module A
10. CAB Only (enclosure address bus port)

HSV110 controllers

One high performance controller is contained in a controller enclosure. The controller is the interface between HP StorageWorks Command View EVA and a storage system. A storage system is composed of one controller pair and multiple drive enclosures.

The Enterprise Virtual Array can contain two HSV110 controllers.

Each HSV110 controller features:

- High performance power PC microprocessor
- An Operator Control Panel (OCP) for easy operation
- Two 2-Gbps Fibre Channel-Switch Fabric host ports
- Four 2-Gbps FC-AL device ports
  - Arranged in redundant pairs
  - Data load/performance is balanced across a pair
  - Support up to 240 disks per controller pair
- 1-GB cache per controller, mirrored, with battery backup
- 2-Gbps FC cache mirroring port with device ports backups
- Dual power supplies

The HSV110 controller has been modified to contain dual power supplies. The dual power supplies allow the controller to efficiently use power from two power sources. In the event of a single power supply failure, the remaining power supply provides the required power to the controller.

Figure 1.9 shows the front and rear views of the HSV110 controller.

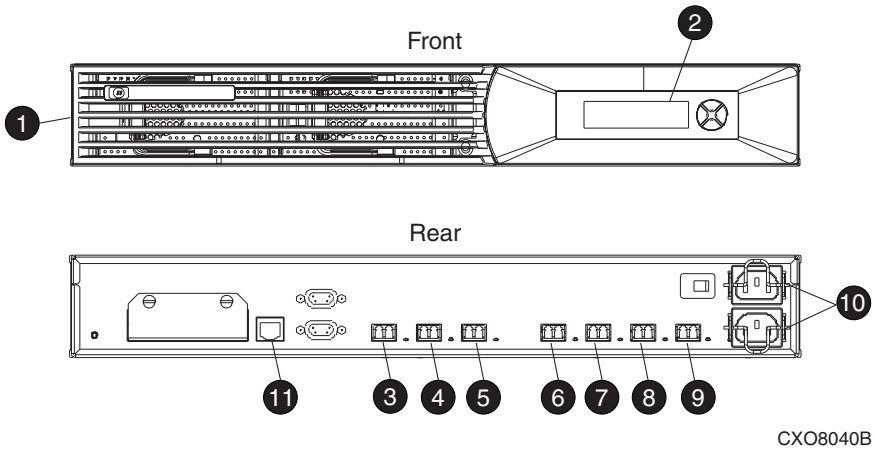


Figure 1.9. HSV110 controller—front and rear views

Callouts:

1. Bezel
2. OCP
3. HF1 port

4. HF2 port
5. Mirror port
6. 1B port
7. 2B port
8. 1A port
9. 2A port
10. Power input
11. CAB (enclosure address bus port)

Fibre channel loop switches

The Enterprise Virtual Array uses four FC loop switches to connect all of the drive enclosures to the controller pair via copper cables. Each FC loop switch acts as a central point of interconnection and establishes a fault-tolerant physical loop topology.

The major features of the FC loop switch are:

- 2.125-Gbps operating speed
- Twelve ports
- Half-width, 1U size
- System and port status LED indicators
- Universal power supply that operates between 100 to 250 VAC (or 50 to 60 Hz)
- Small Form-factor Profile (SFP) transceivers

Figure 1.10 shows the bezel and front and rear views of the Fibre Channel loop switch.

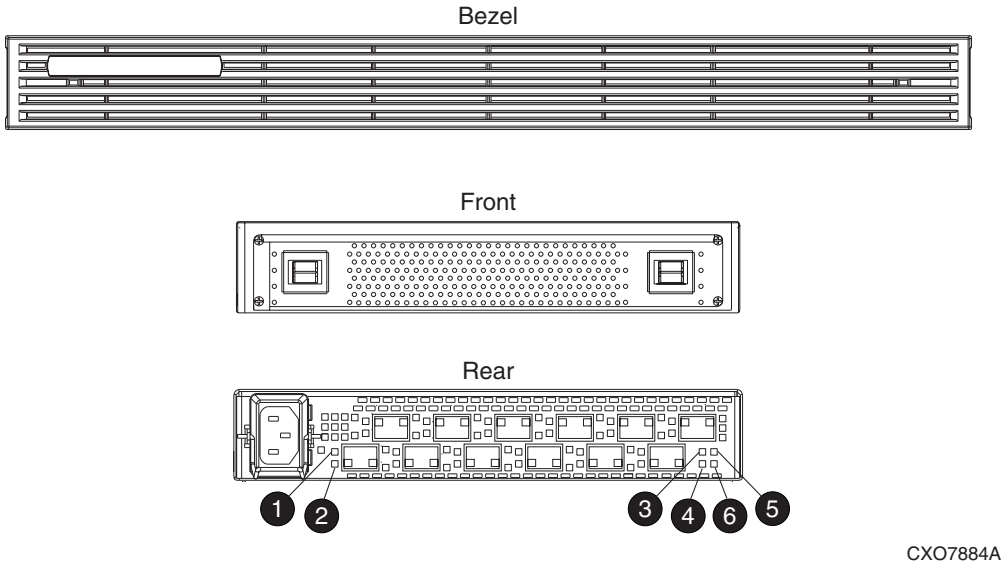


Figure 1.10. FC loop switch—front and rear views

Callouts:

1. SFP Status LED
2. Port Bypassed LED
3. POST Fault LED
4. Over Temp LED
5. Power LED
6. Loop Operational LED

Copper cables

When an Enterprise Virtual Array is installed in the SAN, an SC–to–LC (1-Gb to 2-Gb) cable is required for host connectivity. Furthermore, the Enterprise Virtual Array uses 2-meter LC–to–LC copper cables between the FC loop switches and the FC drive enclosures.

Table 1.7 provides a listing of available cables.

Table 1.7. Copper Cable Lengths

Length
2.0 m (±40 mm)
5.0 m (±80 mm)
15.0 m (±150 mm)
30.0 m (±300 mm)
50.0 m (±500 mm)

Chapter 2. Enterprise Virtual Array 3000 Hardware

This chapter briefly discusses the hardware components in the Enterprise Virtual Array 3000. The following topics are discussed.

- Storage racks
- Fibre Channel drive enclosures
- HSV100 enclosures

Storage racks

The Enterprise Virtual Array 3000 is available in one of four integrated “Independent Bundle” configurations. Each bundle includes one pair of HSV100 controllers, two Fibre Channel drive enclosures, and 8 to 16 integrated Fibre Channel hard drives, varied by bundle. The following racks are available.

22U rack

The 22U rack is graphite in color and 1000 mm (39.4 inches) deep. The 19-inch industry-standard rack provides an enclosure for rack-mountable products with a height of 22U. Perforated front and back doors, 22U solid side panels, and stabilizer come standard.

Figure 2.1 shows the front and rear views of the 22U rack.

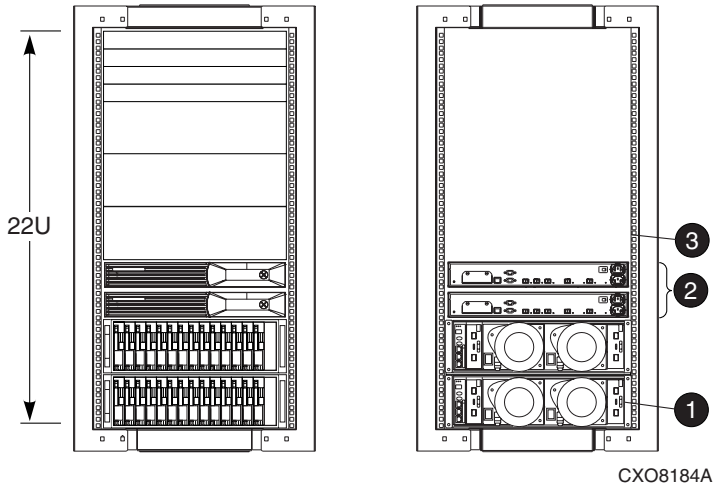


Figure 2.1. 22U rack—front and rear views

Callouts:

1. FC drive enclosure
2. HSV100 controller pair
3. 3U blank

25U rack

The 25U rack is quartz in color and 595.6 mm (23.46 inches) deep. The storage rack features standard 19-inch mounting rails. The 25U rack can support Enterprise Virtual Array configurations that included Fibre Channel loop switches (FC loop switches).

Figure 2.2 shows the front and rear views of the 25U rack.

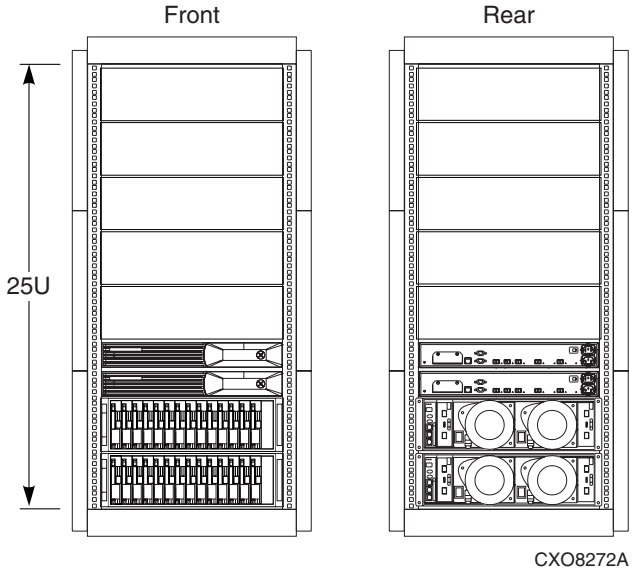


Figure 2.2. 25U rack—front and rear views

Callouts:

1. FC drive enclosure
2. HSV100 controller pair
3. 3U blank

33U rack

The 33U rack is quartz or graphite in color and 609.6 mm (24 inches) deep. The storage rack features standard 19-inch mounting rails. The 33U rack can support Enterprise Virtual Array configurations that include Fibre Channel loop switches.

Figure 2.3 shows the front and rear views of the 33U rack

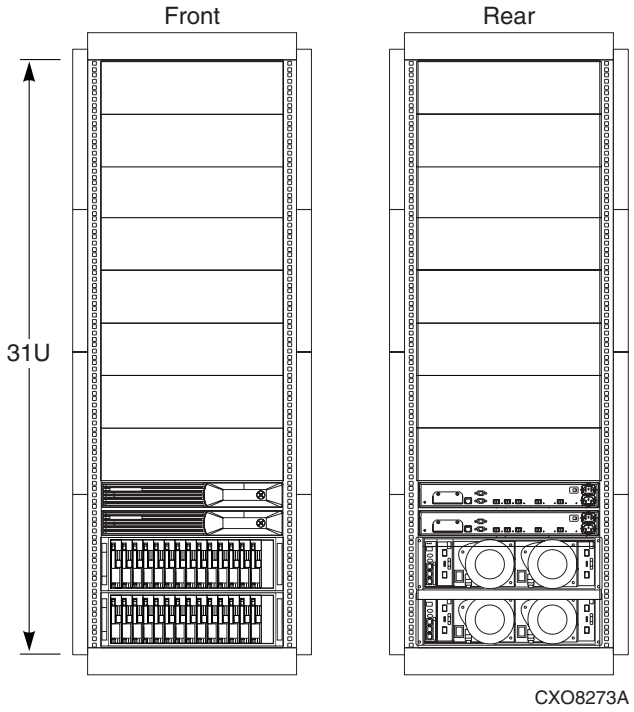


Figure 2.3. 33U rack—front and rear views

Callouts:

1. FC drive enclosure
2. HSV100 controller pair
3. 3U blank

36U rack

The 36U rack is graphite in color and 1000 mm (39.4 inches) deep. The 19-inch industry-standard rack provides an enclosure for rack-mountable products with a height capacity of 36U. Perforated front and back doors are included, and 36U side panels and stabilizer kits are optional.

Figure 2.4 shows the front and rear views of the 36U rack.

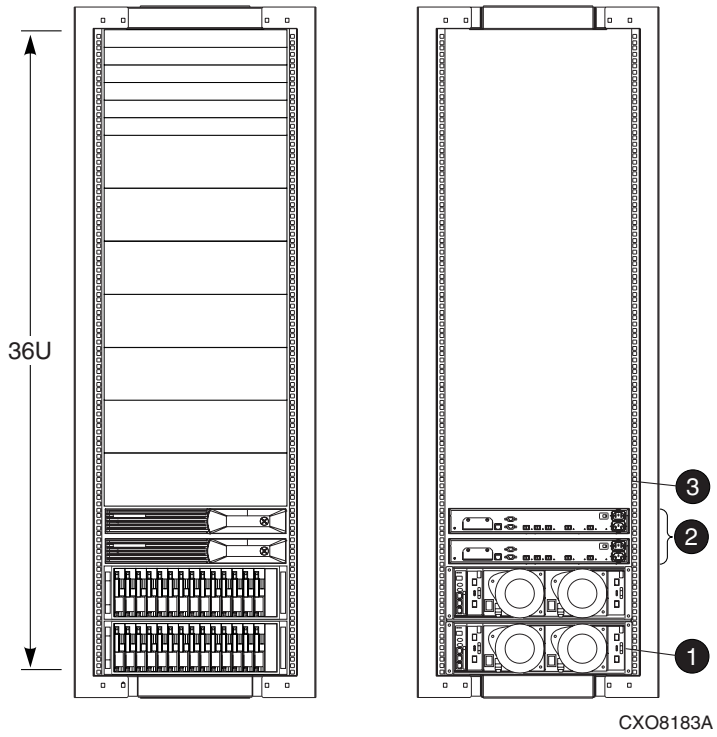


Figure 2.4. 36U rack—front and rear views

Callouts:

1. FC drive enclosure
2. HSV100 controller pair
3. 3U blank

41U rack

The 41U rack is graphite in color and 993 mm (39.1 inches) deep. The storage rack features standard 19-inch mounting rails. The 41U rack can support Enterprise Virtual Array configurations that include Fibre Channel loop switches.

Figure 2.5 shows the front and rear views of a 41U rack.

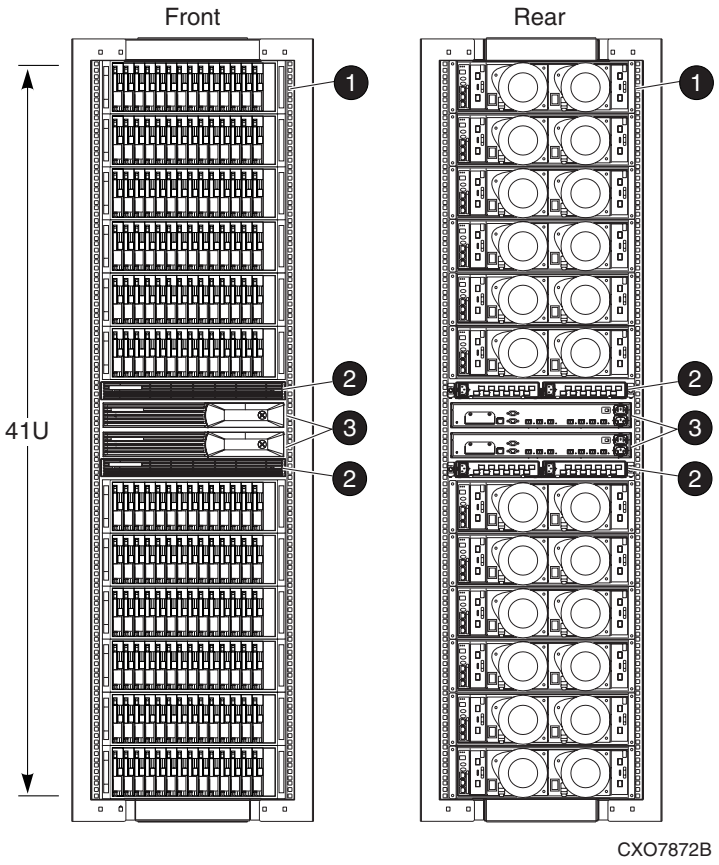


Figure 2.5. 41U rack—front and rear views

Callouts:

1. FC drive enclosure
2. FC loop switches
3. Controller pair

42U rack

The 42U rack is graphite in color and 909 mm (35.8 inches) deep. The storage rack features standard 19-inch mounting rails.

Figure 2.6 shows the front and rear views of a 42U rack.

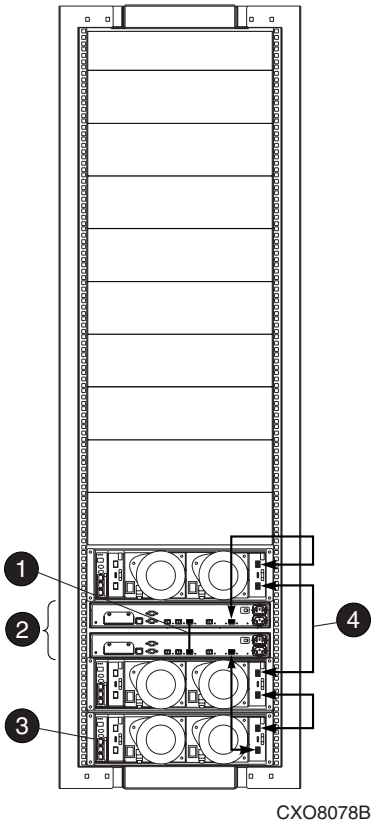


Figure 2.6. 42U rack—front and rear views

Callouts:

1. FC drive enclosure
2. HSV100 controller pair
3. 3U blank

2C2D features

The following features are included in the 2C2D configuration:

- One storage rack
- Two HSV100 controllers
- Two 14-drive bay FC drive enclosures
- Six internal copper cables
- Three 2-port enclosure address bus junction boxes
- Eight AC strips
- Two 0U PDUs

Note

Disks must be ordered separately.

The 2C2D configuration can contain 28 disk drives and a maximum storage capacity of 8.4 TB (Table 1.4).

You can expand the storage capacity of the 2C2D configuration by adding FC drive enclosures to the rack.

Figure 2.7 shows the rear view of the 2C2D configuration.

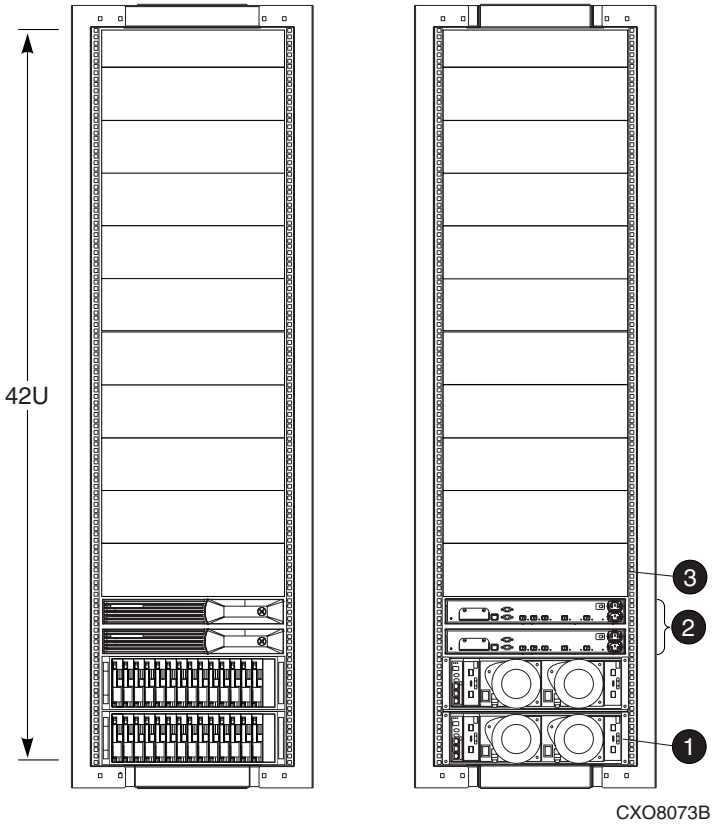


Figure 2.7. 2C2D configuration—rear view

Callouts:

1. FC drive enclosure
2. Controller pair
3. Blank

Fibre channel drive enclosures

Each FC drive enclosure includes the following features:

- 3U drive enclosure
- Dual redundant, active-to-active, 2-Gbps Fibre Channel loops
- Fourteen 1-inch Fibre Channel disks per enclosure
- Environmental Monitor Unit
- Dual 2-Gbps Fibre Channel I/O module—A and B
- Dual 500-W redundant hot-plug power supplies and fans

For ease of reference, the disk drives are usually referred to by their physical location, the drive bay number.

Figure 2.8 shows the front and rear views of the FC drive enclosure and the physical location of each drive bay.

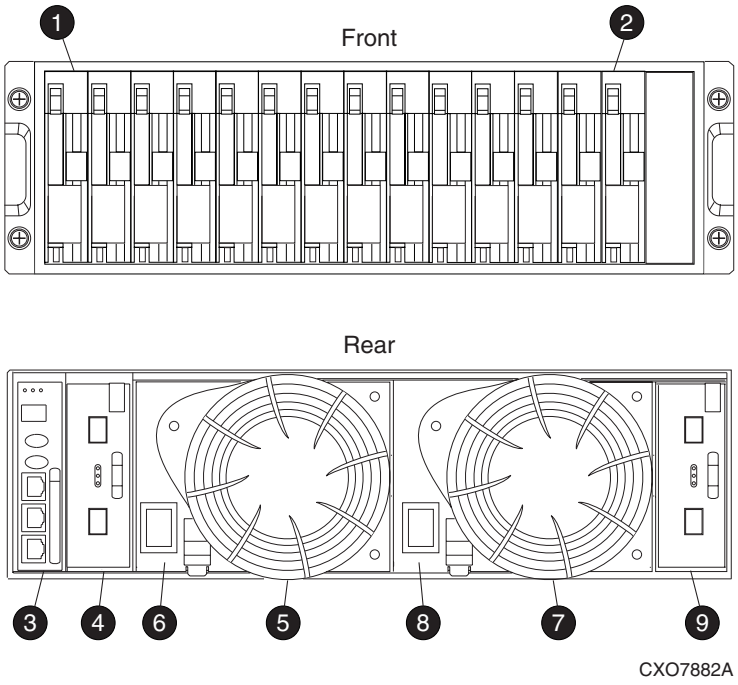


Figure 2.8. FC drive enclosure—front and rear views

Callouts:

1. Drive bay 1
2. Drive bay 14
3. EMU
4. I/O module B
5. Blower 1
6. Power supply 1

7. Blower 2
8. Power supply 2
9. I/O module A

HSV100 enclosures

One high-performance HSV100 controller is contained in each controller enclosure. The HSV100 controller is the interface between the HP StorageWorks Command View EVA and a storage system. A storage system is composed of one HSV100 controller pair and multiple drive enclosures.

The Enterprise Virtual Array 3000 can contain two HSV100 controllers.

Each HSV100 controller features:

- High-performance power PC microprocessor
- An Operator Control Panel (OCP) for easy operation
- Two 2-Gbps Fibre Channel-Switch Fabric host ports
- Two 2-Gbps FC-AL device ports
  - Arranged in redundant pairs
  - Data load/performance is balanced across a pair
  - Supports up to 56 disks
- 1-GB cache per controller, mirrored, with battery backup
- 2-Gbps FC cache mirroring port with device port backups
- Dual power supplies

The HSV100 controller contains dual power supplies. The dual power supplies allow the HSV100 controller to efficiently use power from two power sources. In the event of a single power supply failure, the remaining power supply provides the required power to the HSV100 controller.

Figure 2.9 shows the front and rear views of the HSV100 controller.

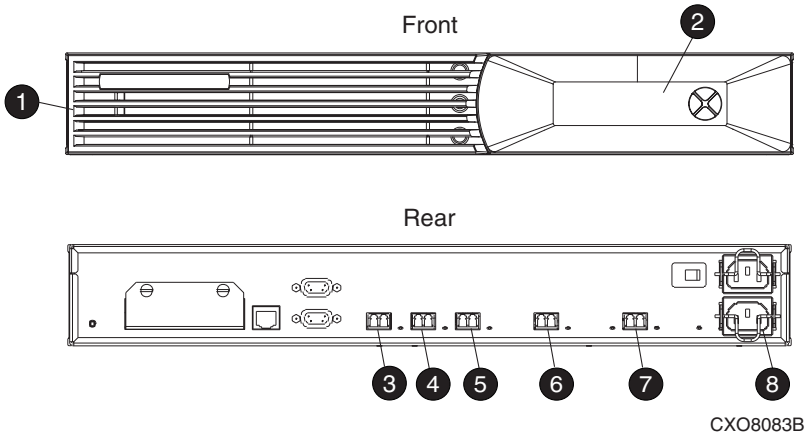


Figure 2.9. HSV100 controller—front and rear views

Callouts:

1. Bezel
2. OCP

3. HF1 port
4. HF2 port
5. Mirror port
6. 1B port
7. 1A port
8. Power input

Chapter 3. Enterprise Virtual Array 5000 Configurations

This chapter briefly discusses various Enterprise Virtual Array 5000 configurations. Each section describes the placement of controllers, drive enclosures, FC loop switches, enclosure address bus junction boxes and cables, and copper cables

This chapter contains the following sections:

2C12D configuration

The 2C12D configuration can contain 168 disk drives and a maximum storage capacity of 50.4 TB (see Table 1.2).

The 2C12D configuration is available in either the 41U rack or the 42U rack. The 2C12D can contain four FC loop switches or one expansion panel.

Enclosure address bus configuration

The 2C12D configuration contains seven enclosure address bus junction boxes at 6U increments in the left rear rail of the rack. The FC drive enclosures and controller pair in the 2C12D configuration use all seven enclosure address bus junction boxes. Each FC drive enclosure should be connected to an enclosure address bus junction box. The FC drive enclosures connect to each enclosure address bus junction box in pairs. The controller pair connects to the enclosure address bus junction box with a Y cable. Figure 3.1 shows the enclosure address bus cable configuration for the 2C12D configuration.

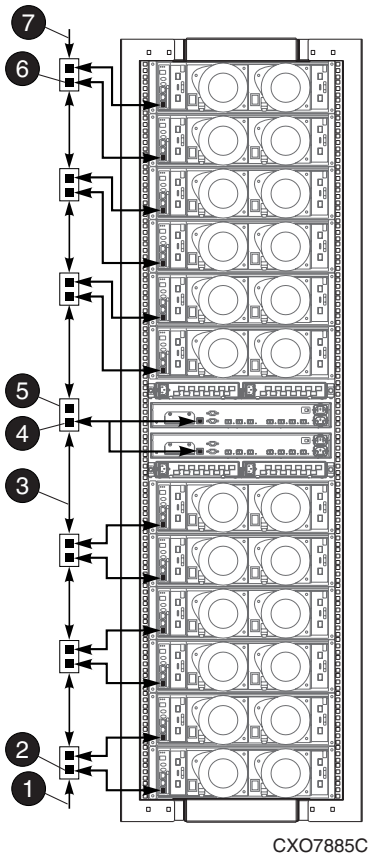


Figure 3.1. 2C12D configuration—enclosure address bus cables

Callouts:

1. Bottom terminator
2. Enclosure address 1
3. Enclosure address bus cable
4. Enclosure address 7

5. Enclosure address bus junction box
6. Enclosure address 13
7. Top terminator

Fibre Channel loop configurations

The 2C12D configuration contains four Fibre Channel loops. A Fibre Channel loop is formed when the FC drive enclosures and the controller pair are connected by copper cables. The 2C12D configuration can use an FC loop switch or an expansion panel to achieve the desired Fibre Channel loop configuration.

When a configuration uses FC loop switches, each FC drive enclosure in a loop is directly connected to the associated FC loop switch. The controller pair is also connected directly to the associated FC loop switch. When the FC loop switch is powered on, it completes a Fibre Channel loop.

When a configuration uses an expansion panel, a Fibre Channel loop is achieved by connecting two FC drive enclosures directly to the controllers and linking each FC drive enclosure together in a chain.

Table 3.1 provides the locations for the Fibre Channel loops in a storage rack.

Table 3.1. Fibre Channel Loop Locations in Rack

Fibre Channel Loop	Location in Rack (viewed from rear)
1A	Lower right side
1B	Lower left side
2A	Upper right side
2B	Upper left side

Figure 3.2, Figure 3.3, Figure 3.4, and Figure 3.5 show the 2C12D Fibre Channel loop configurations with the FC loop switches. Figure 3.6, Figure 3.7, Figure 3.8, and Figure 3.9 show the 2C12D Fibre Channel loop configurations with expansion panels.

Figure 3.2 shows Fibre Channel loop 1A and the associated FC loop switch.

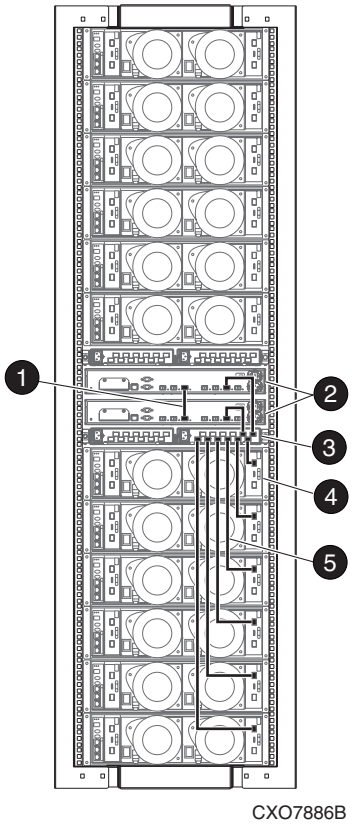


Figure 3.2. 2C12D configuration—Fibre Channel loop 1A with FC loop switch

Callouts:

1. Controller-to-controller Mirror port FC cable
2. Controller pair
3. FC loop switch
4. FC drive enclosure
5. Fibre Channel cable

Figure 3.3 shows Fibre Channel loop 1B and the associated FC loop switch.

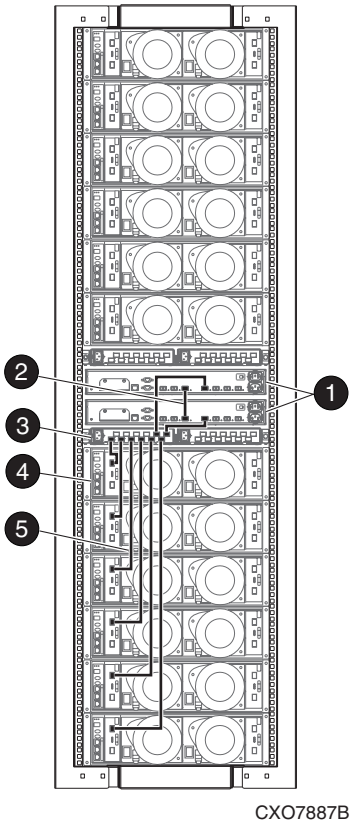


Figure 3.3. 2C12D configuration—Fibre Channel loop 1B with FC loop switch

Callouts:

1. Controller pair
2. Controller-to-controller Mirror port FC cable
3. FC loop switch
4. FC drive enclosure
5. Fibre Channel cable

Figure 3.4 shows Fibre Channel loop 2A and the associated FC loop switch.

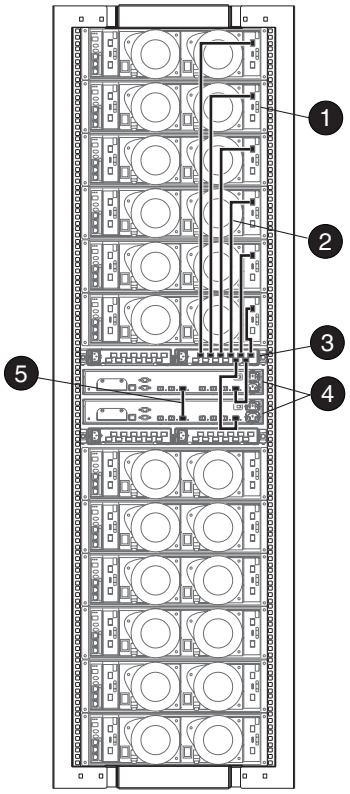


Figure 3.4. 2C12D configuration—Fibre Channel loop 2A with FC loop switch

Callouts:

1. FC drive enclosure
2. Fibre Channel cable
3. FC loop switch
4. Controller pair
5. Controller-to-controller Mirror port FC cable

Figure 3.5 shows Fibre Channel loop 2B and the associated FC loop switch.

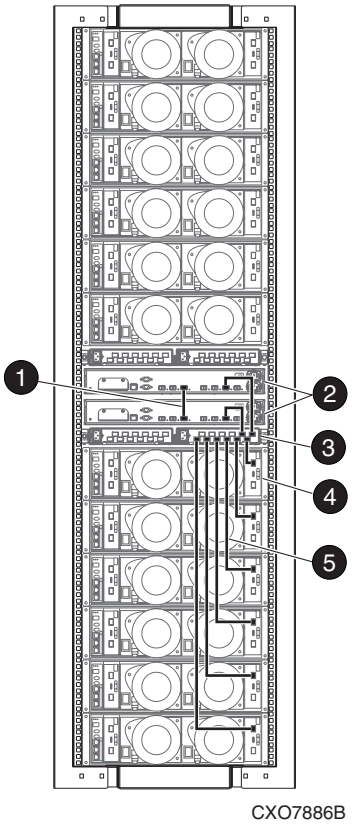


Figure 3.5. 2C12D configuration—Fibre Channel loop 2B with FC loop switch

Callouts:

1. Fibre Channel cable
2. FC loop switch
3. Controller-to-controller Mirror port
4. FC drive enclosure
5. Controller pair

Figure 3.6 shows Fibre Channel loop 1A in the 42U rack with the expansion panel.

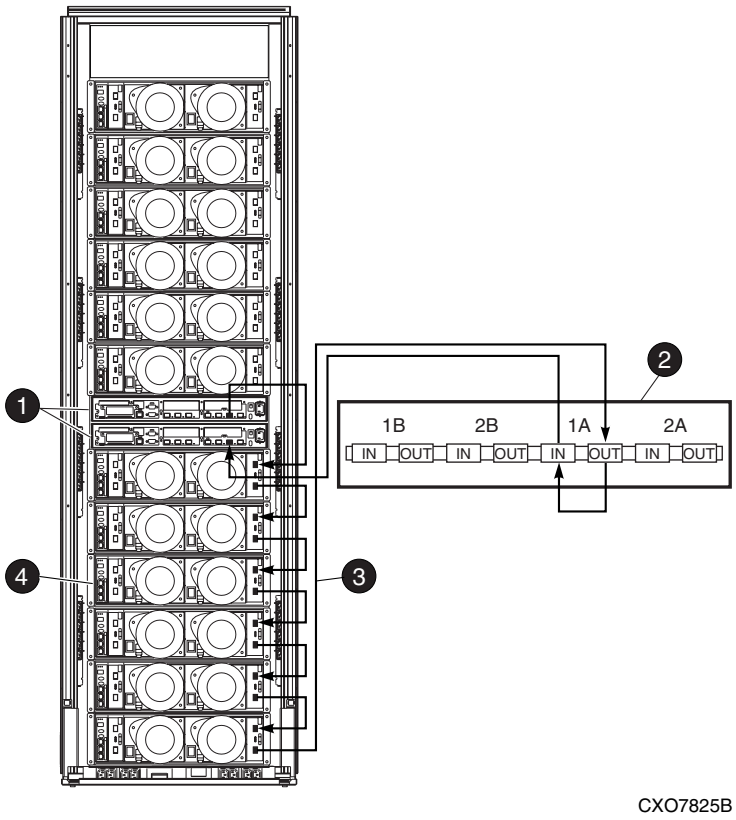


Figure 3.6. 2C12D configuration—Fibre Channel loop 1A with expansion panel

Callouts:

1. Controller pair
2. Expansion pane
3. Fibre Channel cable
4. FC drive enclosure

Figure 3.7 shows Fibre Channel loop 1B in the 42U rack with the expansion panel.

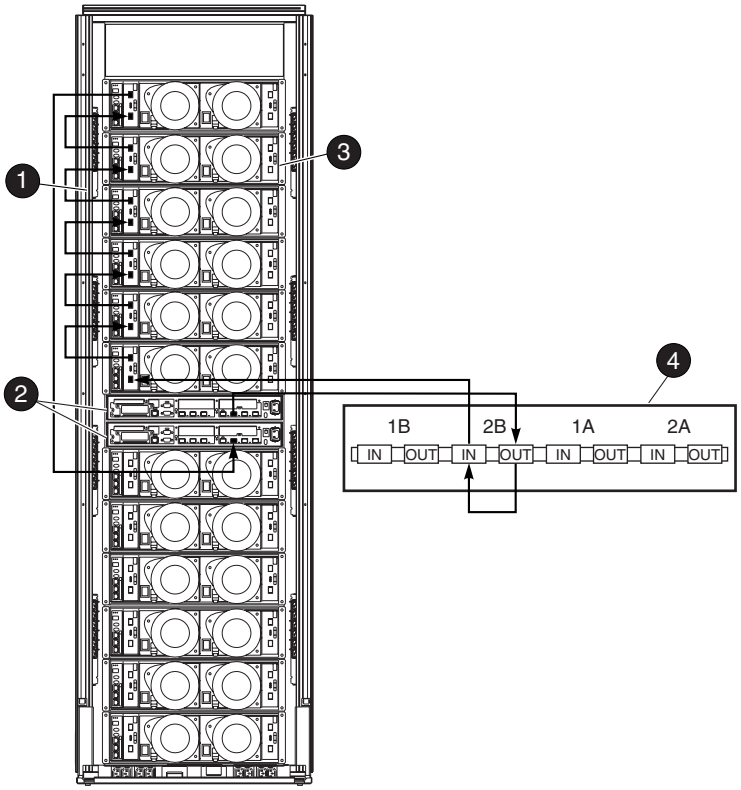


Figure 3.7. 2C12D configuration—Fibre Channel loop 1B with expansion panel

Callouts:

1. Controller pair
2. Expansion pane
3. Fibre Channel cable
4. FC drive enclosure

Figure 3.8 shows Fibre Channel loop 2A in the 42U rack with the expansion panel.

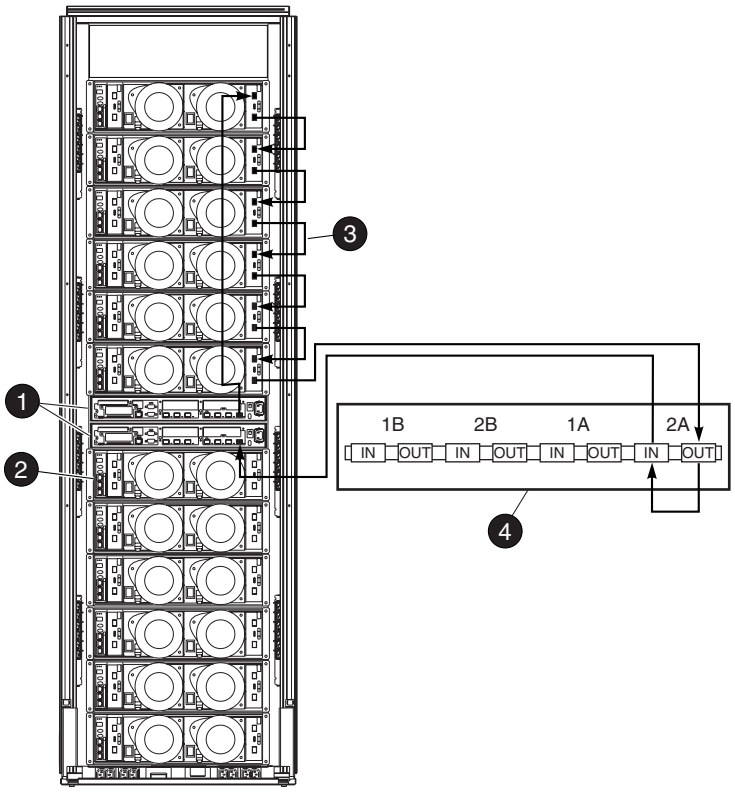


Figure 3.8. 2C12D configuration—Fibre Channel loop 2A with expansion panel

Callouts:

1. Controller pair
2. FC drive enclosure
3. Fibre Channel cable
4. Expansion panel

Figure 3.9 shows Fibre Channel loop 2B in the 42U rack with the expansion panel.

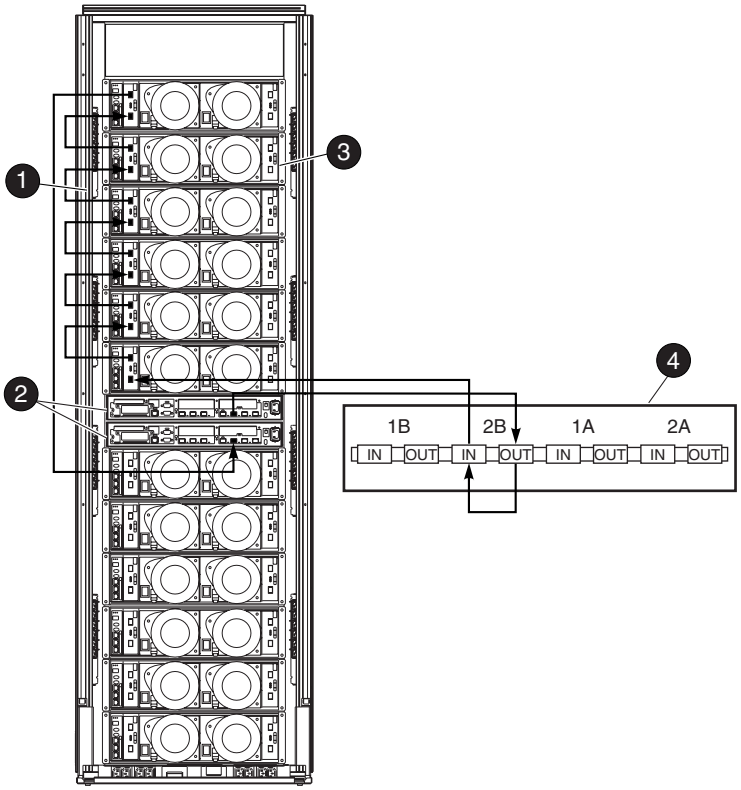


Figure 3.9. 2C12D configuration—Fibre Channel loop 2B with expansion panel

Callouts:

1. Fibre Channel cable
2. Controller pair
3. FC drive enclosure
4. Expansion panel

Cable management configurations

A configuration can have two different cable management configurations. If the configuration uses FC loop switches, the configuration uses a combination of cable containment spools and a cable management arm to organize the copper cables. If the configuration uses expansion panels, the configuration uses cable containment spools to organize the copper cables.

Cable management arms

When the configuration uses FC loop switches, the configuration contains two cable management arms. All of the copper cables in the configuration pass through one of the cable management arms. Each cable management arm can hold several radial clips. Each radial clip can hold a maximum of seven copper cables. The cable management arms can hold all of the copper cables within a storage system configuration.

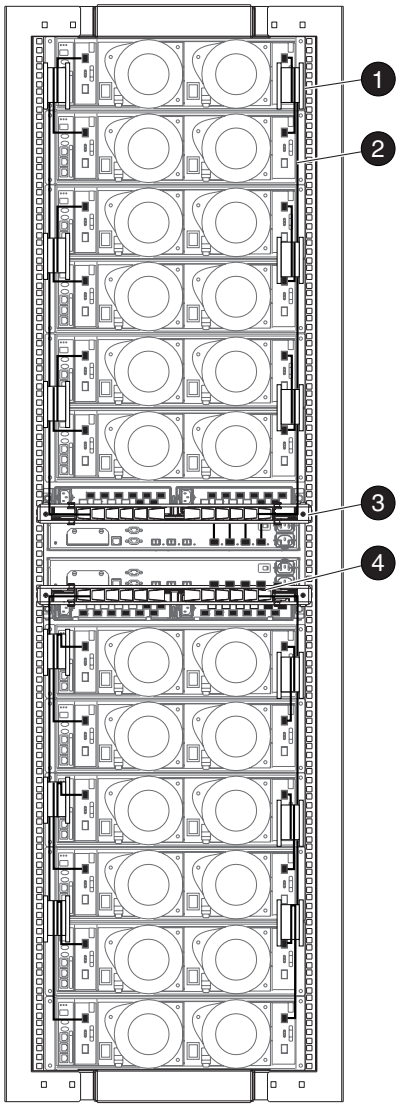
Each rack contains four flumes. These flumes are placed next to the cable management arms on the left and right sides of the rack. Each flume guides the copper cables from the cable containment spools to the cable management arms.

Cable containment spools

The cable containment spools hold the copper cables. These cable containment spools gather up extra cable length and guide the copper cables from the FC drive enclosures to the flumes located on the sides of the rack.

The number of cable containment spools varies by rack configuration. Racks with more FC drive enclosures contain more cable containment spools.

The 2C12D configuration contains 12 cable containment spools and two cable management arms. Figure 3.10 shows the cable management configuration for the 2C12D configuration.



CXO7901B

Figure 3.10. 2C12D cable management configuration

Callouts:

1. Cable containment spool
2. Fibre Channel cable

3. Cable management arm
4. Radial clip

2C6D configuration

The 2C6D configuration can contain 72 disk drives and a maximum storage capacity of 25.2 TB (Table 1.1).

The 2C6D configuration is available in either the 41U rack or the 42U rack. The 2C6D can contain four FC loop switches or one expansion panel.

Enclosure address bus configuration

The 2C6D configuration contains seven enclosure address bus junction boxes at 6U increments in the left rear rail of the rack. Each FC drive enclosure should be connected to an enclosure address bus junction box. The FC drive enclosures connect to each enclosure address bus junction box in pairs. The controller pair connects to the enclosure address bus junction box with a Y cable. Figure 3.11 shows the enclosure address bus cable configuration for the 2C6D configuration.

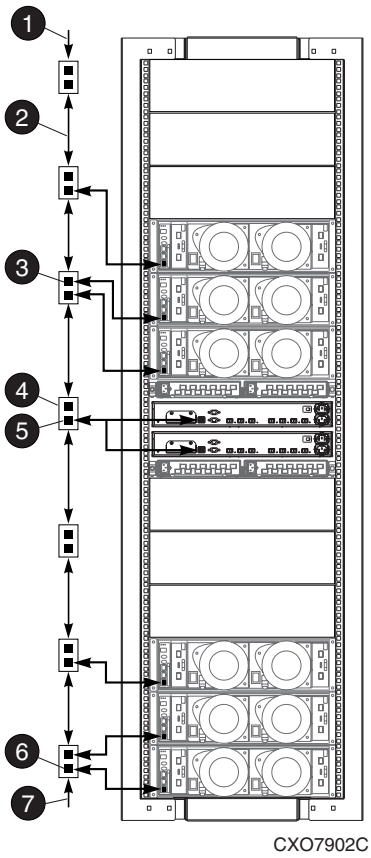


Figure 3.11. 2C6D configuration—enclosure address bus cables

Callouts:

1. Top terminator
2. Enclosure address bus cable
3. Enclosure address 10
4. Enclosure address bus junction box

5. Enclosure address 7
6. Enclosure address 1
7. Bottom terminator

Fibre channel loop configuration

The 2C6D configuration contains four Fibre Channel loops. A Fibre Channel loop is formed when the FC drive enclosures and the controller pair are connected by copper cables. The 2C6D configuration can use an FC loop switch or an expansion panel to achieve the desired Fibre Channel loop configuration. (Refer to Fibre Channel loop configurations for more information about the use of FC loop switches and expansion panels in the FC loop configurations.)

Refer to Table 3.1 for the locations of the Fibre Channel loops in a storage rack.

Figure 3.12, Figure 3.13, Figure 3.14, and Figure 3.15 show the 2C6D Fibre Channel loop configurations with the FC loop switches. Figure 3.16, Figure 3.17, Figure 3.18, and Figure 3.19 show the 2C6D Fibre Channel loop configurations with an expansion panel.

Figure 3.12 shows Fibre Channel loop 1A and the associated FC loop switch.

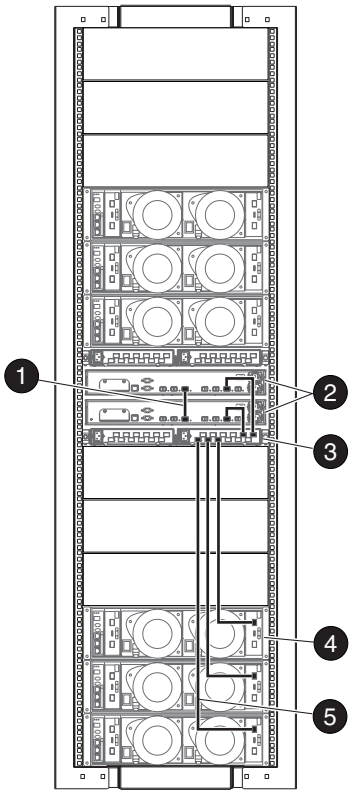


Figure 3.12. 2C6D configuration—Fibre Channel loop 1A with FC loop switch

Callouts:

1. Controller-to-controller Mirror port FC cable
2. Controller pair

3. FC loop switch
4. FC drive enclosure
5. Fibre Channel cable

Figure 3.13 shows Fibre Channel loop 1B and the associated FC loop switch.

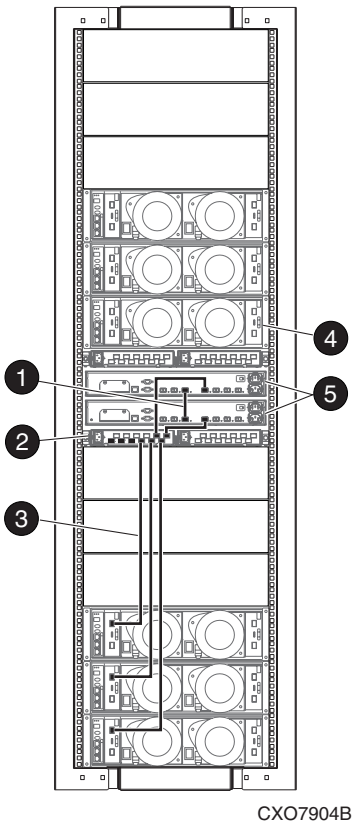


Figure 3.13. 2C6D configuration—Fibre Channel loop 1B with FC loop switch

Callouts:

1. Controller-to-controller Mirror port FC cable
2. FC loop switch
3. Fibre Channel cable
4. FC drive enclosure
5. Controller pair

Figure 3.14 shows Fibre Channel loop 2A and the associated FC loop switch.

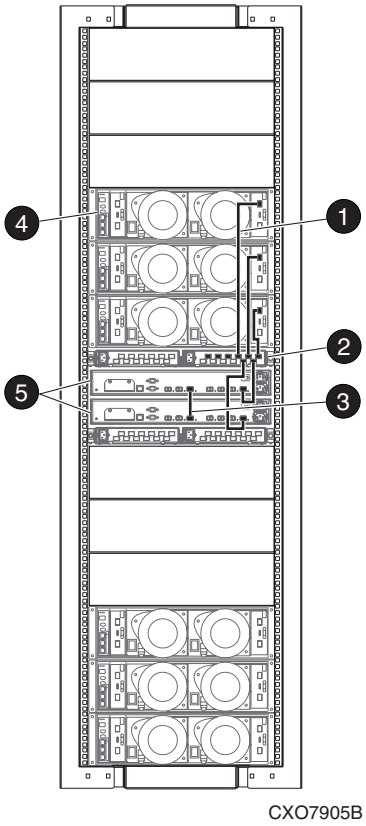


Figure 3.14. 2C6D configuration—Fibre Channel loop 2A with FC loop switch

Callouts:

1. Fibre Channel cable
2. FC loop switch
3. Controller-to-controller Mirror port FC cable
4. FC drive enclosure
5. Controller pair

Figure 3.15 shows Fibre Channel loop 2B and the associated FC loop switch.

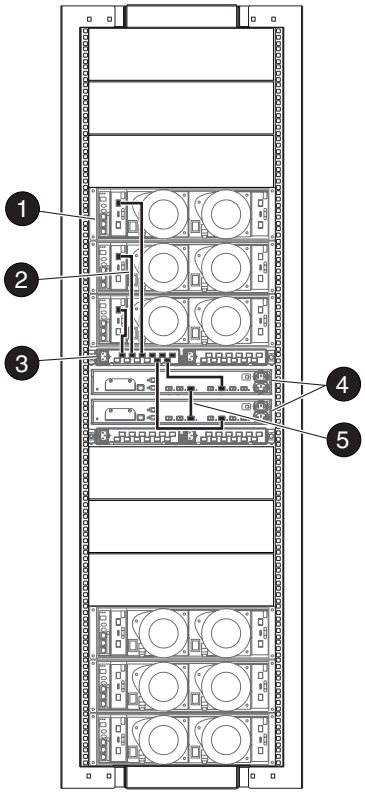


Figure 3.15. 2C6D configuration—Fibre Channel loop 2B with FC loop switch

Callouts:

1. FC drive enclosure
2. Fibre Channel cable
3. FC loop switch
4. Controller pair
5. Controller-to-controller Mirror port FC cable

Figure 3.16 shows Fibre Channel loop 1A in the 42U rack with the expansion panel.

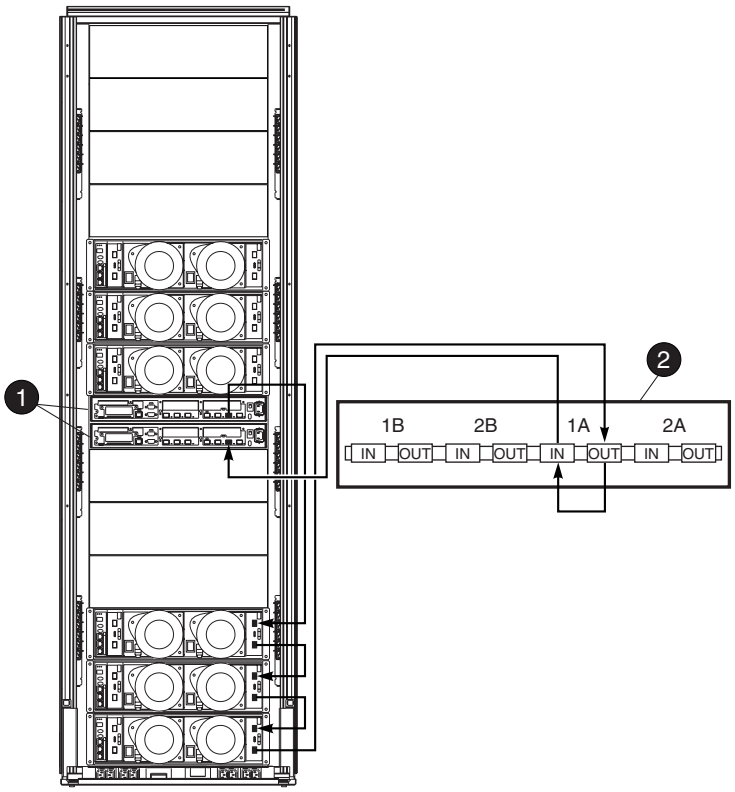


Figure 3.16. 2C6D configuration—Fibre Channel loop 1A with expansion panel

Callouts:

1. Controller pair
2. Expansion panel

Figure 3.17 shows Fibre Channel loop 1B in the 42U rack with the expansion panel.

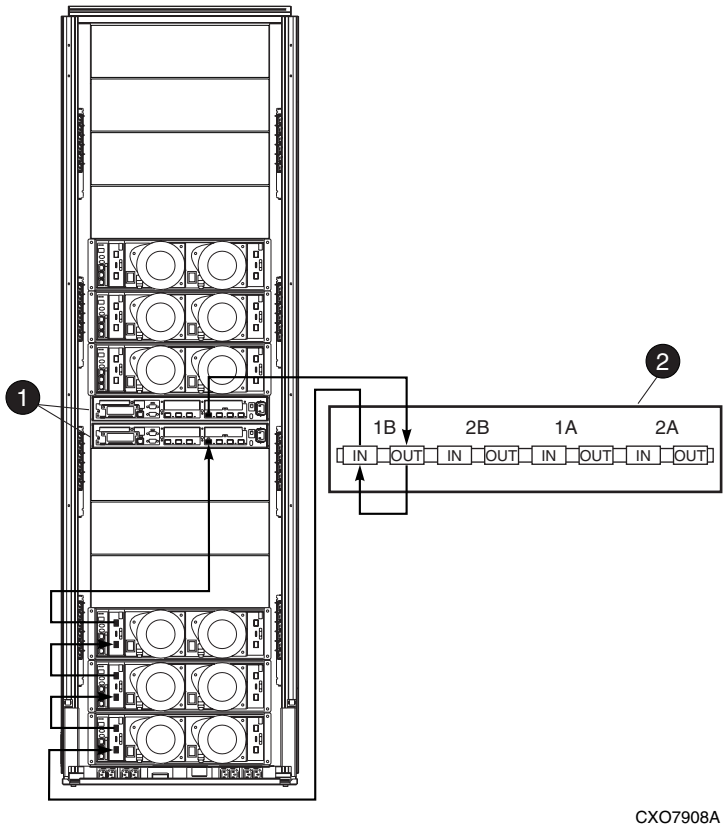


Figure 3.17. 2C6D configuration—Fibre Channel loop 1B with expansion panel

Callouts:

1. Controller pair
2. Expansion panel

Figure 3.18 shows Fibre Channel loop 2A in the 42U rack with the expansion panel.

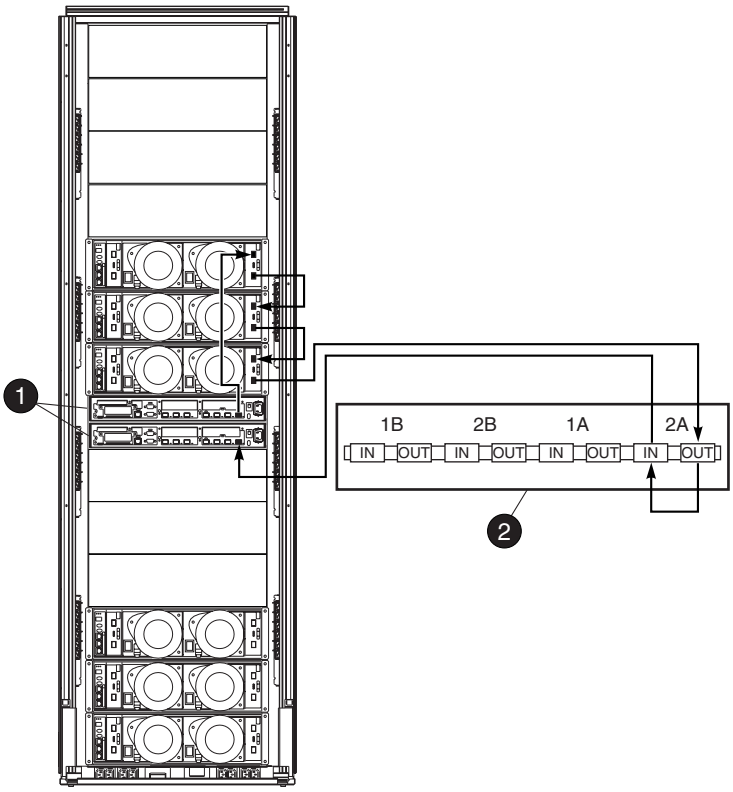


Figure 3.18. 2C6D configuration—Fibre Channel loop 2A with expansion panel

Callouts:

1. Controller pair
2. Expansion panel

Figure 3.19 shows Fibre Channel loop 2B in the 42U rack with the expansion panel.

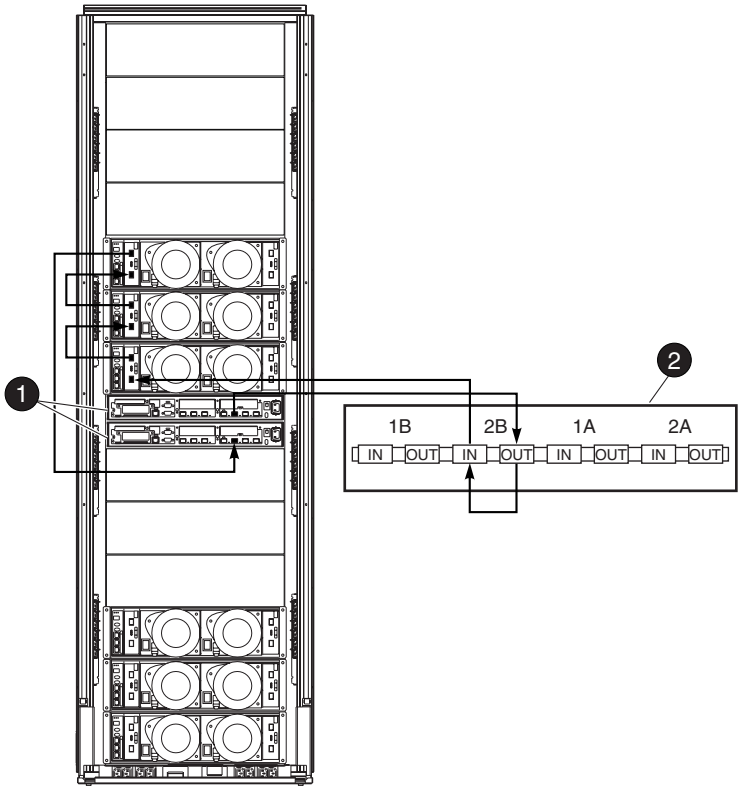


Figure 3.19. 2C6D configuration—Fibre Channel loop 2B with expansion panel

Callouts:

1. Controller pair
2. Expansion panel

Cable management configurations

The 2C6D configuration contains six cable containment spools and two cable management arms.

Please see Cable management configurations in the 2C12D configuration section for more information about cable containment spools and cable management arms.

Figure 3.20 shows the cable management configuration in the 2C6D configuration.

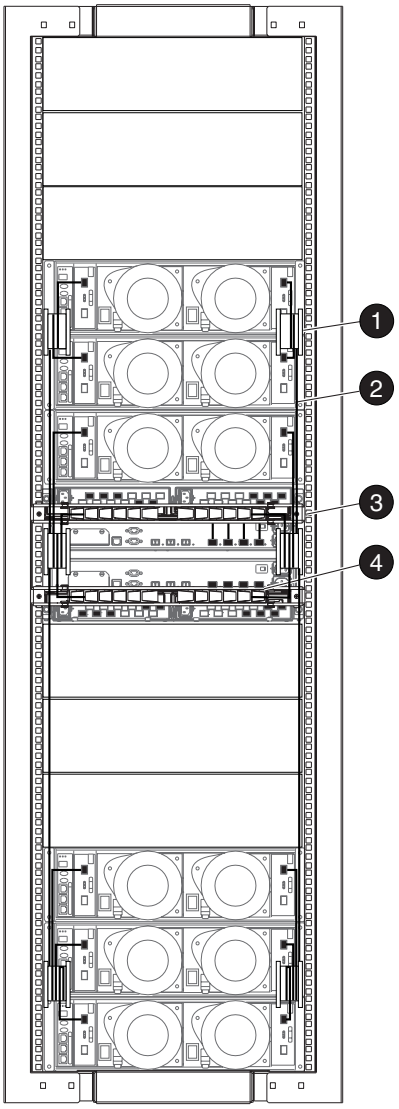


Figure 3.20. 2C6D cable management configuration

Callouts:

1. Cable containment spool
2. Fibre Channel cable
3. Cable management arm
4. Radial clip

8C8D configuration

The 8C8D configuration can contain 112 disk drives and a maximum storage capacity of 33.6 TB (Table 1.3).

The 8C8D configuration is available in either the 41U rack or the 42U rack.

Enclosure address bus configuration

The 8C8D configuration contains seven enclosure address bus junction boxes at 6U increments in the left rear rail of the rack. Each FC drive enclosure should be connected to an enclosure address bus junction box. The FC drive enclosures connect to each enclosure address bus junction box in pairs. The controller pairs connect to the enclosure address bus junction boxes with a Y cable. Figure 3.21 shows the enclosure address bus cable configuration for the 8C8D configuration.

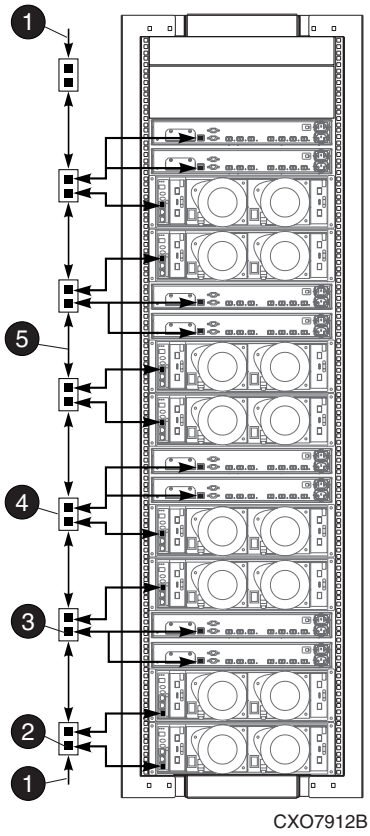


Figure 3.21. 8C8D configuration—enclosure address bus cables

Callouts:

1. Terminator
2. Enclosure address 1
3. Enclosure address 3
4. Enclosure address bus junction box
5. Enclosure address bus cable

Fibre channel loop configurations

The 8C8D configuration contains 16 Fibre Channel loops. A Fibre Channel loop is formed when the FC drive enclosures and the controller pair are connected by copper cables. The 8C8D configuration does not use FC loop switches or expansion panels. Instead, each I/O port on an FC drive enclosure is connected directly to a controller with a Fibre Channel cable.

Figure 3.22 shows the four 1A Fibre Channel loops.

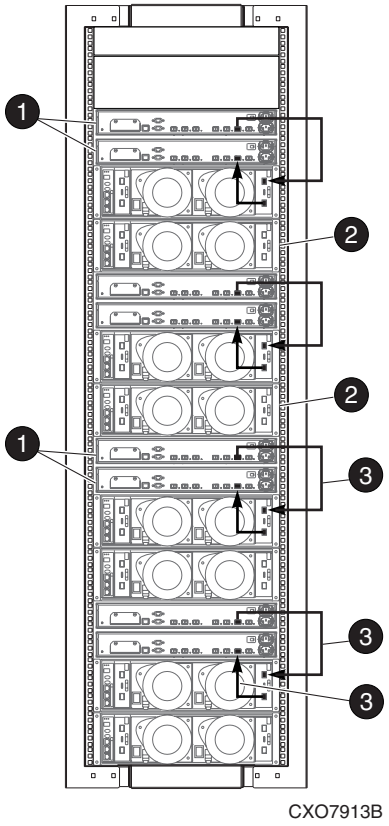


Figure 3.22. 8C8D configuration—Fibre Channel loop 1A

Callouts:

1. Controller pair
2. FC drive enclosure
3. Fibre Channel cable

Figure 3.23 shows the four 1B Fibre Channel loops.

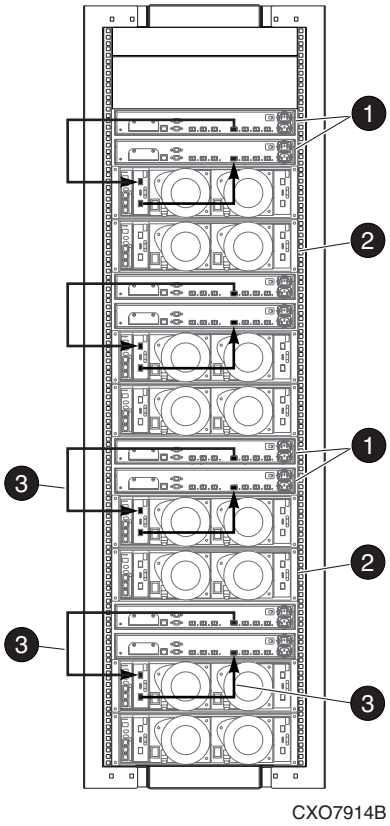


Figure 3.23. 8C8D configuration—Fibre Channel loop 1B

Callouts:

1. Controller pair FC drive enclosure Fibre Channel cable
2. FC drive enclosure
3. Fibre Channel cable

Figure 3.24 shows the four 2A Fibre Channel loops.

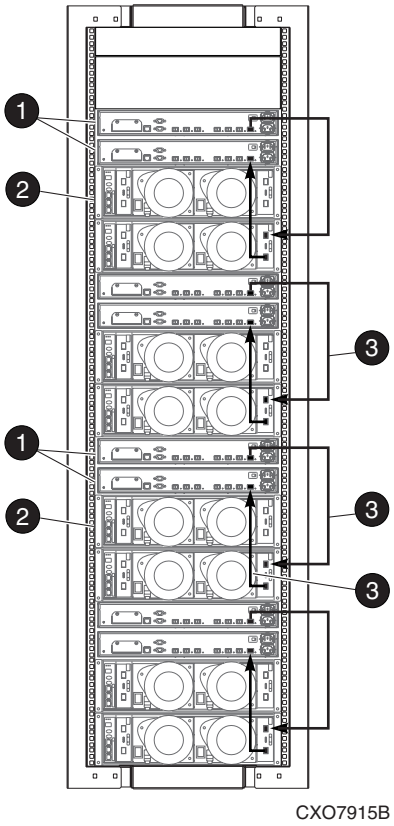


Figure 3.24. 8C8D configuration—Fibre Channel loop 2A

Callouts:

1. Controller pair
2. FC drive enclosure
3. Fibre Channel cable

Figure 3.25 shows the four 2B Fibre Channel loops.

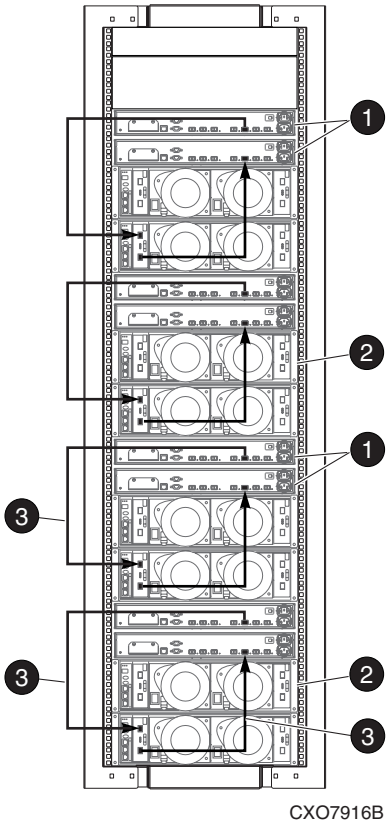


Figure 3.25. 8C8D configuration—Fibre Channel loop 2B

Callouts:

1. Controller pair
2. FC drive enclosure
3. Fibre Channel cable

Cable management configurations

The 8C8D configuration contains eight cable containment spools and no cable management arms.

Please see Cable management configurations in the 2C12D configuration section for more information about cable containment spools and cable management arms.

Figure 3.26 shows the cable management configuration in the 8C8D configuration.

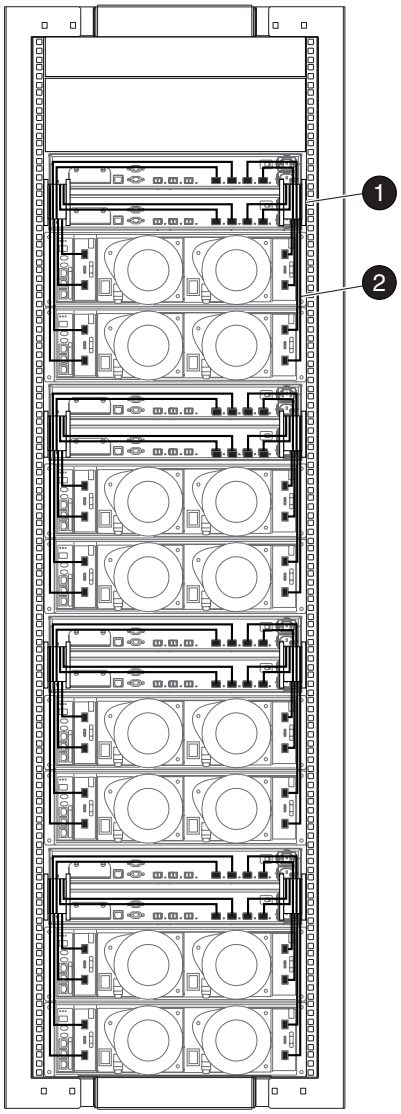


Figure 3.26. 8C8D cable management configuration

Callouts:

1. Cable containment spool
2. Fibre Channel cable

2C2D configuration

The 2C2D configuration can contain 28 disk drives and a maximum storage capacity of 8.4 TB (Table 1.4). You can expand the capacity of the 2C2D configuration by adding more drive enclosures and four FC loop switches.

The 2C2D configuration is available in the 41U rack.

Enclosure address bus configuration

The 2C2D configuration contains seven enclosure address bus junction boxes at 6U increments in the left rear rail of the rack. Each FC drive enclosure should be connected to an enclosure address bus junction box. The FC drive enclosures connect to each enclosure address bus junction box in pairs. The controller pair connects to the enclosure address bus junction boxes with a Y cable. Figure 3.27 shows the enclosure address bus cable configuration for the 2C2D configuration.

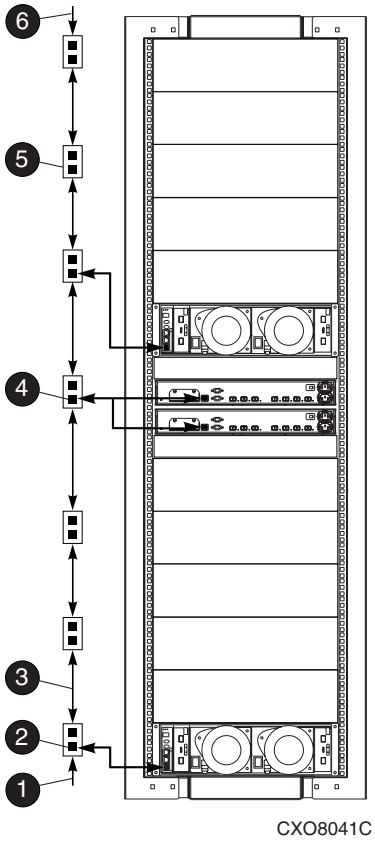


Figure 3.27. 2C2D configuration—enclosure address bus cables

Callouts:

1. Bottom terminator
2. Enclosure address 1
3. Enclosure address bus cable
4. Enclosure address 7
5. Enclosure address junction box
6. Top terminator

Fibre channel loop configurations

The 2C2D configuration contains four Fibre Channel loops. A Fibre Channel loop is formed when the FC drive enclosures and the controller pair are connected by copper cables. The

2C2D configuration does not use FC loop switches or expansion panels. Instead, each I/O port on an FC drive enclosure is connected directly to a controller with a Fibre Channel cable.

Refer to Table 3.1 for the locations of the Fibre Channel loops in a storage rack.

Figure 3.28 shows Fibre Channel loop 1A.

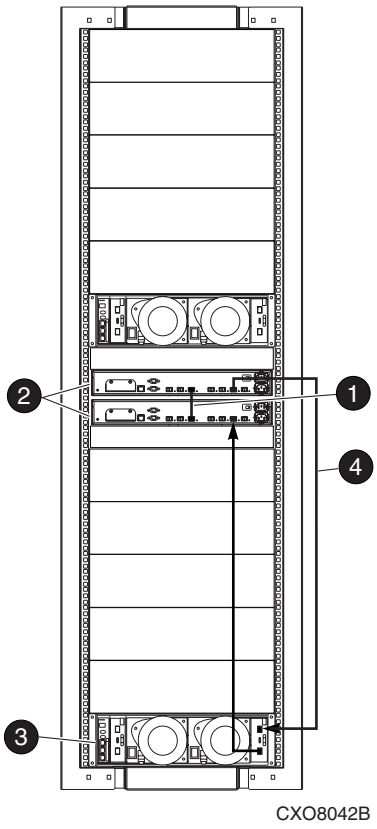


Figure 3.28. 2C2D configuration—Fibre Channel loop 1A

Callouts:

1. Controller-to-controller Mirror port FC cable
2. HSV110 controller pai
3. FC drive enclosure
4. Fibre Channel cable

Figure 3.29 shows Fibre Channel loop 1B.

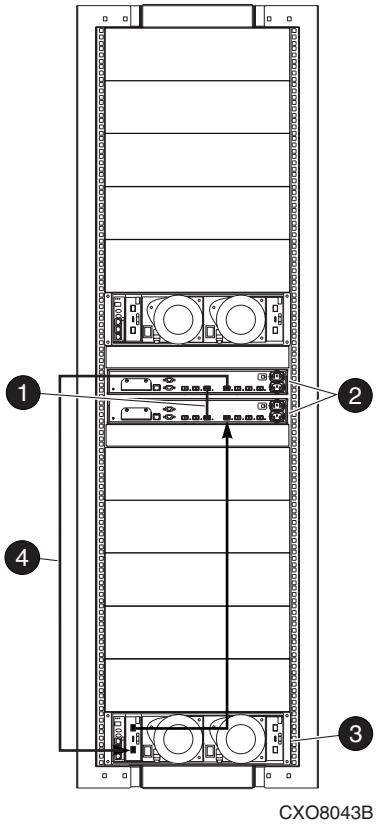


Figure 3.29. 2C2D configuration—Fibre Channel loop 1B

Callouts:

1. Controller-to-controller Mirror port FC cable
2. HSV110 controller pair
3. FC drive enclosure
4. Fibre Channel cable

Figure 3.30 shows Fibre Channel loop 2A.

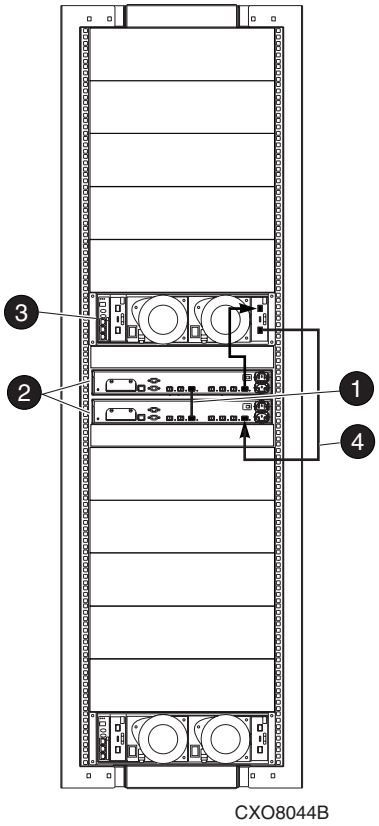


Figure 3.30. 2C2D configuration—Fibre Channel Loop 2A

Callouts:

1. Controller-to-controller Mirror port FC cable
2. HSV110 controller pair
3. FC drive enclosure
4. Fibre Channel cable

Figure 3.31 shows Fibre Channel loop 2B.

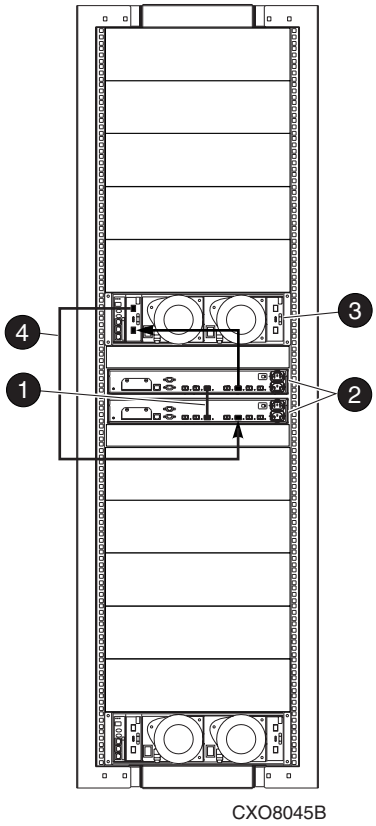


Figure 3.31. 2C2D configuration—Fibre Channel loop 2B

Callouts:

1. Controller-to-controller Mirror port FC cable
2. HSV110 controller pair
3. FC drive enclosure
4. Fibre Channel cable

Cable management configurations

The 2C2D configuration contains four cable containment spools and no cable management arms.

Please see Cable management configurations in the 2C12D configuration section for more information about cable containment spools and cable management arms.

Figure 3.32 shows the cable management configuration for the 2C2D configuration.

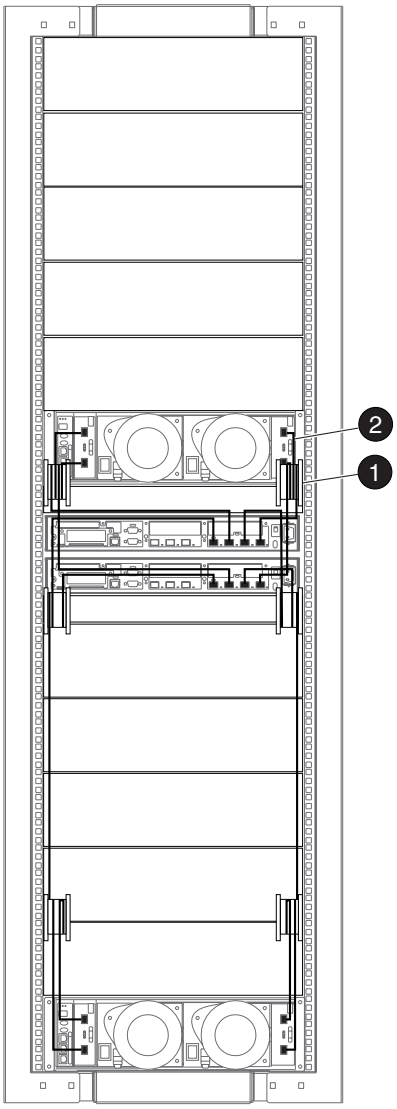


Figure 3.32. 2C2D cable management configuration

Callouts:

1. Cable containment spool
2. Fibre Channel cable

2C12D + 0C6D configuration

The 2C12D + 0C6D configuration is a dual-rack configuration that provides up to 72 TB by expanding from 168 disks to 240 disks. The 0C6D rack connects to the 2C12D rack with enclosure address bus cables and copper cables.

Table 3.2. Maximum Storage Capacity for the 2C12D + 0C6D Configuration

Disk Size	Maximum Capacity
36.4 GB	8.7 TB
72.8 GB	17.5 TB
146 GB	35 TB
250 GB	60 TB
300 GB	72 TB

Enclosure address bus configuration

Each rack contains enclosure address bus junction boxes at 6U increments in the left rear rail of the rack. The 0C6D rack contains six enclosure address bus junction boxes; however, the FC drive enclosures use only three of the enclosure address bus junction boxes. The 2C12D rack contains seven enclosure address bus junction boxes. The FC drive enclosures and controller pair in the 2C12D rack use all seven enclosure address bus junction boxes.

The two racks are connected by one enclosure address bus cable, which connects to the bottom enclosure address bus junction box on each rack. The enclosure address bus cable between the racks is polarized. The P1 end of the cable connects to the bottom enclosure address bus junction box on the 2C12D rack. The P2 end of the cable connects to the bottom enclosure address bus junction box on the 0C6D rack.

Note

Make sure the P1 end of the enclosure address bus cable is plugged into the 2C12D rack and the P2 end of the enclosure address bus cable is plugged into the 0C6D rack. If the cable is connected to the racks incorrectly, Command View EVA places the FC drive enclosures in the Unmappable Hardware folder.

In order to connect two racks with an enclosure address bus cable, the HP Authorized Service Representative will have to remove the bottom terminator on the master rack (2C12D rack).

Figure 3.33 shows the enclosure address bus cable configuration in the 2C12D + 0C6D configuration.

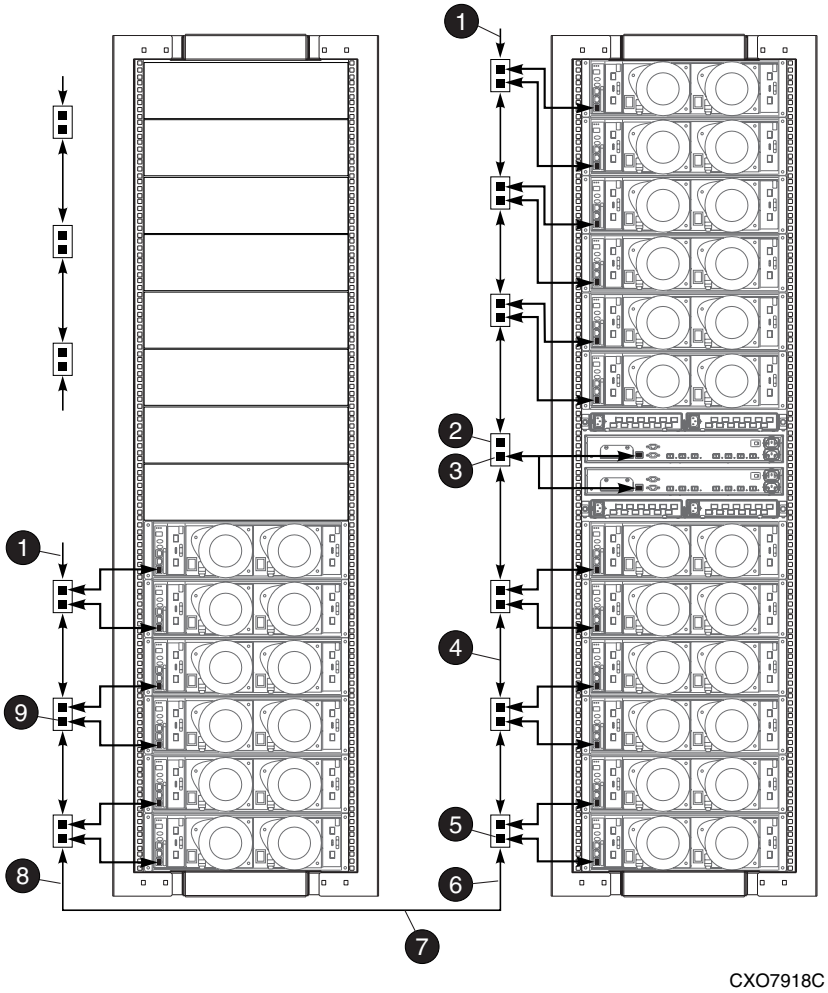


Figure 3.33. 2C12D + 0C6D configuration—enclosure address bus cables

Callouts:

1. Top terminator
2. Enclosure address bus junction box
3. Enclosure address 07
4. Enclosure address bus cable
5. Enclosure address 01
6. P1 end of rack-to-rack enclosure address bus cable
7. 5-meter rack-to-rack enclosure address bus cable
8. P2 end of rack-to-rack enclosure address bus cable
9. Enclosure address 17

Fibre channel loop configurations

The 2C12D configuration contains four Fibre Channel loops. A Fibre Channel loop is formed when the FC drive enclosures and the controller pair are connected by copper cables. The

2C12D configuration can use an FC loop switch or an expansion panel to achieve the desired Fibre Channel loop configuration.

When the 2C12D + 0C6D configuration uses FC loop switches, each FC drive enclosure in a loop is directly connected to the associated FC loop switch. The controller pair is also connected directly to the associated FC loop switch. When the FC loop switch is powered on, it completes a Fibre Channel loop.

When the 2C12D + 0C6D configuration uses expansion panels, all of the FC drive enclosures in a loop are connected to the controller pair in the master rack. The 2C12D + 0C6D configuration uses expansion panels to achieve this configuration.

Refer to Fibre Channel loop configurations for locations of Fibre Channel loops in a storage rack.

Figure 3.34 shows Fibre Channel loop 1A and the associated FC loop switch.

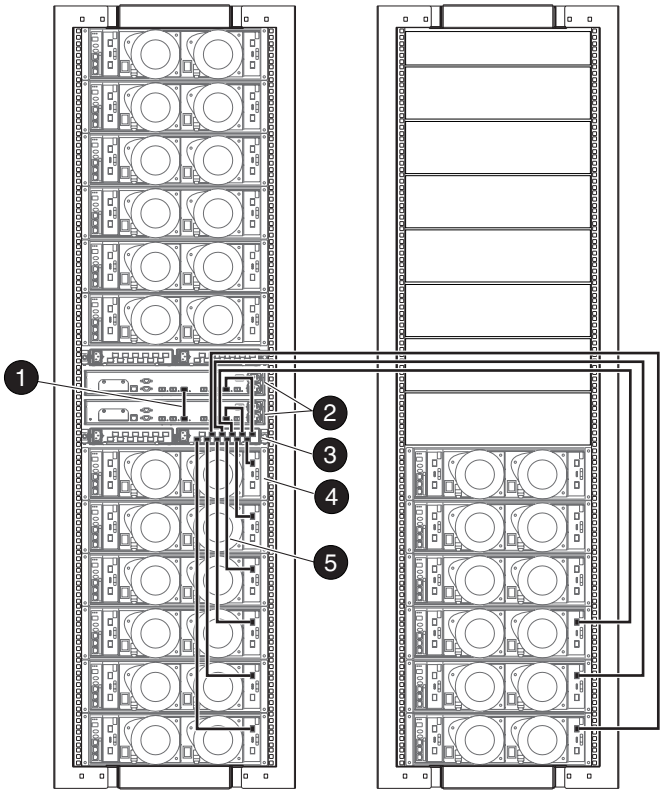


Figure 3.34. 2C12D + 0C6D configuration—Fibre Channel loop 1A with FC loop switch

Callouts:

1. Controller-to-controller Mirror port FC cable
2. Controller pair
3. FC loop switch
4. FC drive enclosure
5. Fibre Channel cable

Figure 3.35 shows Fibre Channel loop 1B and the associated FC loop switch.

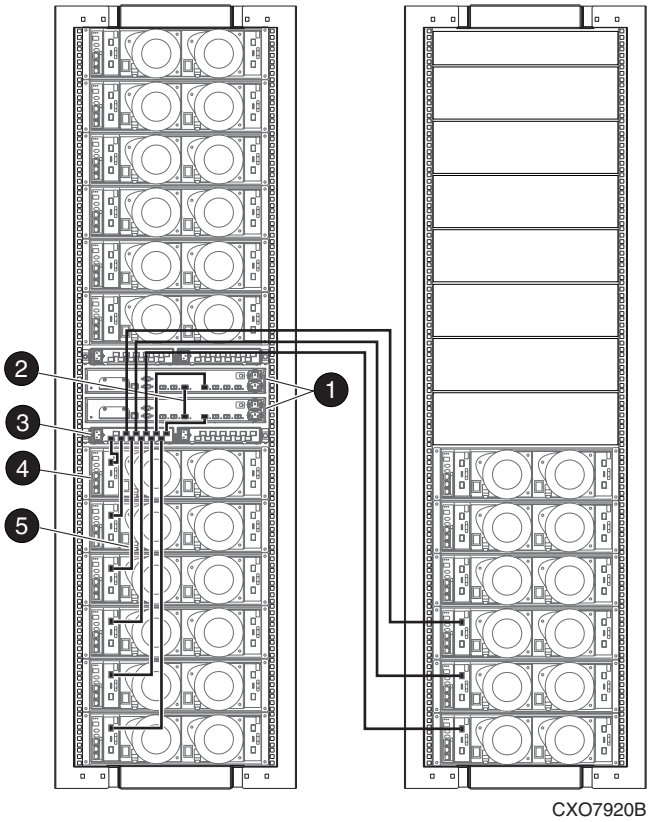


Figure 3.35. 2C12D configuration—Fibre Channel loop 1B with FC loop switch

Callouts:

1. Controller pair Controller-to-controller mirror port
2. FC cable
3. FC loop switch
4. FC drive enclosure
5. Fibre Channel cable

Figure 3.36 shows Fibre Channel loop 2A and the associated FC loop switch.

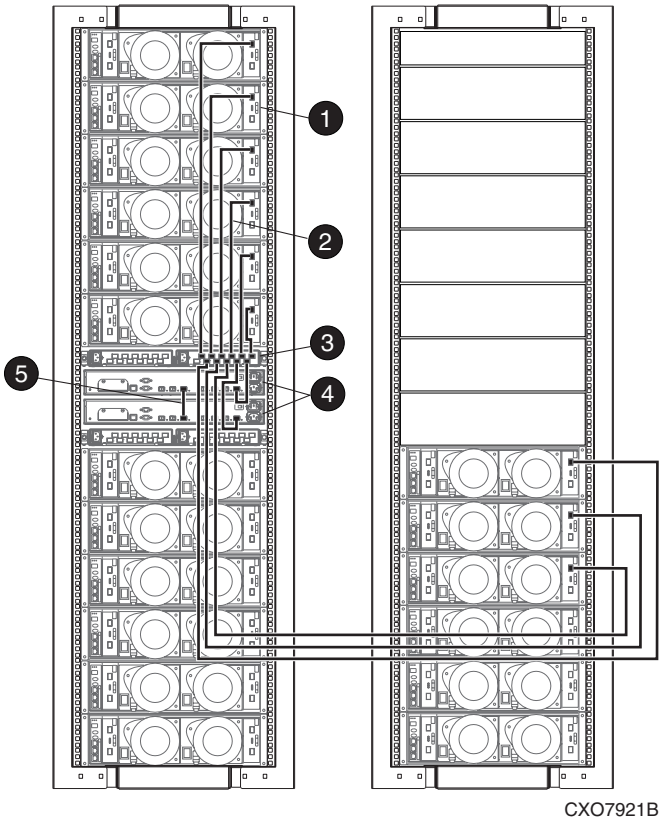


Figure 3.36. 2C12D configuration—Fibre Channel loop 2A with FC loop switch

Callouts:

1. FC drive enclosure
2. Fibre Channel cable
3. FC loop switch
4. Controller pair
5. Controller-to-controller mirror port FC cable

Figure 3.37 shows Fibre Channel loop 2B and the associated FC loop switch.

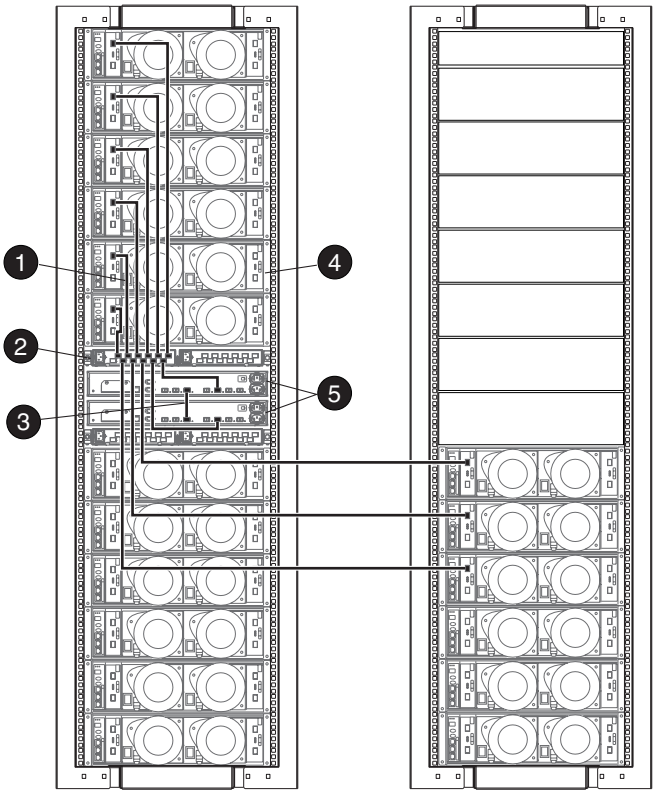


Figure 3.37. 2C12D configuration—Fibre Channel loop 2B with FC loop switch

Callouts:

1. Fibre Channel cable
2. FC loop switch
3. Controller-to-controller mirror port FC cable
4. Mirror port FC cable FC drive enclosure
5. Controller pair

Figure 3.38 shows Fibre Channel loop 1A with expansion panels.

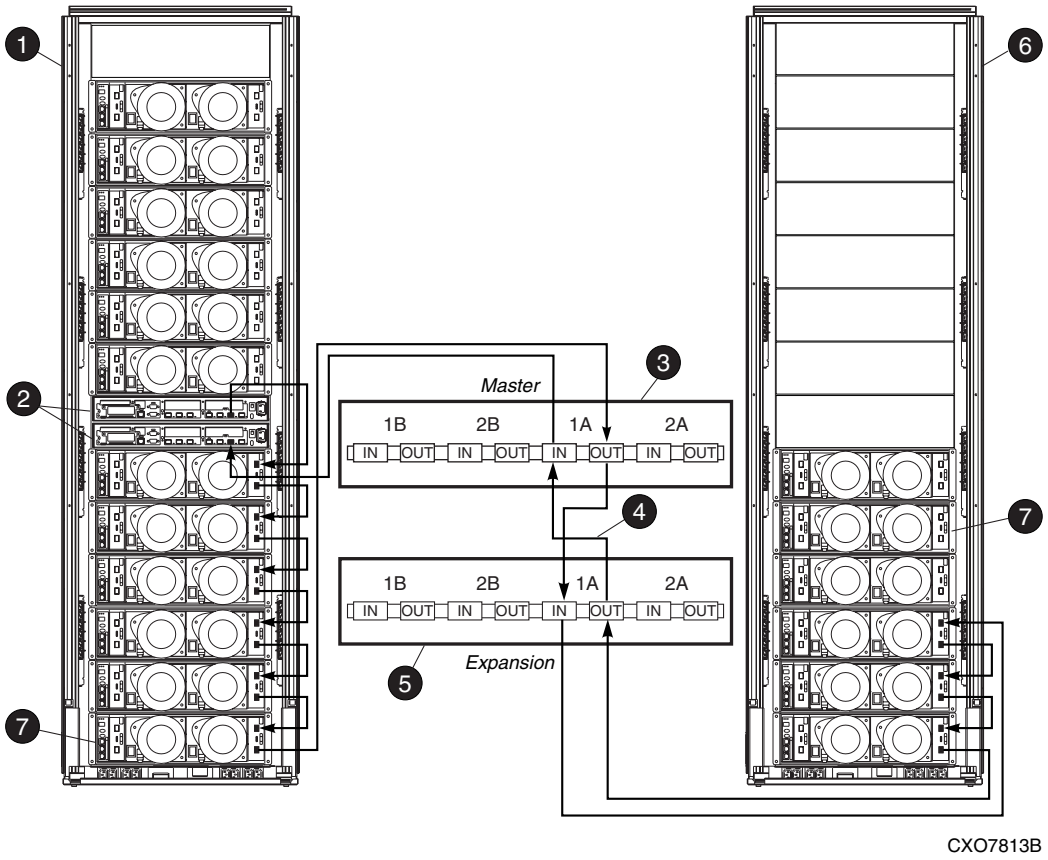


Figure 3.38. 2C12D + 0C6D configuration—Fibre Channel loop 1A with expansion panels

Callouts:

1. Master rack
2. Controller pair
3. Master rack expansion panel
4. 5-meter rack-to-rack copper cables
5. Expansion rack expansion panel
6. Expansion rack
7. FC drive enclosure

Figure 3.39 shows Fibre Channel Loop 1B with expansion panels.

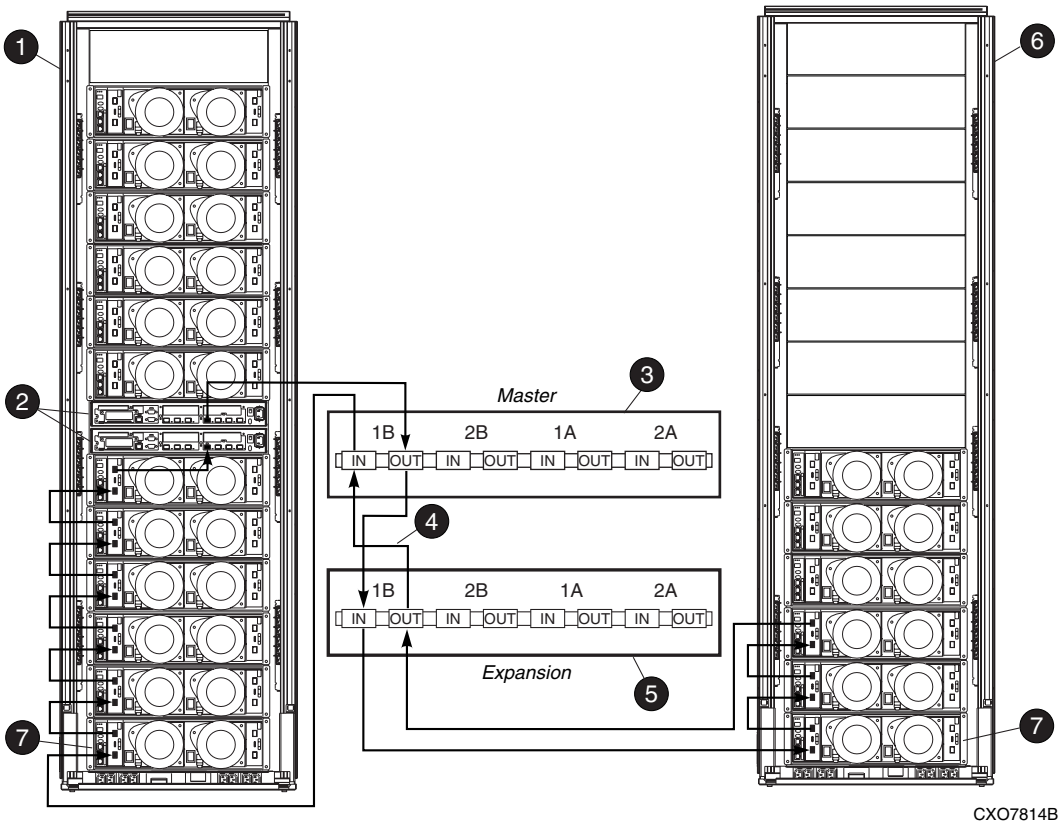


Figure 3.39. 2C12D + 0C6D configuration—Fibre Channel Loop 1B with expansion panels

Callouts:

1. Master rack
2. Controller pair
3. Master rack expansion panel
4. 5-meter rack-to-rack copper cables
5. Expansion rack expansion panel
6. Expansion rack
7. FC drive enclosure

Figure 3.40 shows Fibre Channel loop 2A and the associated FC loop switch.

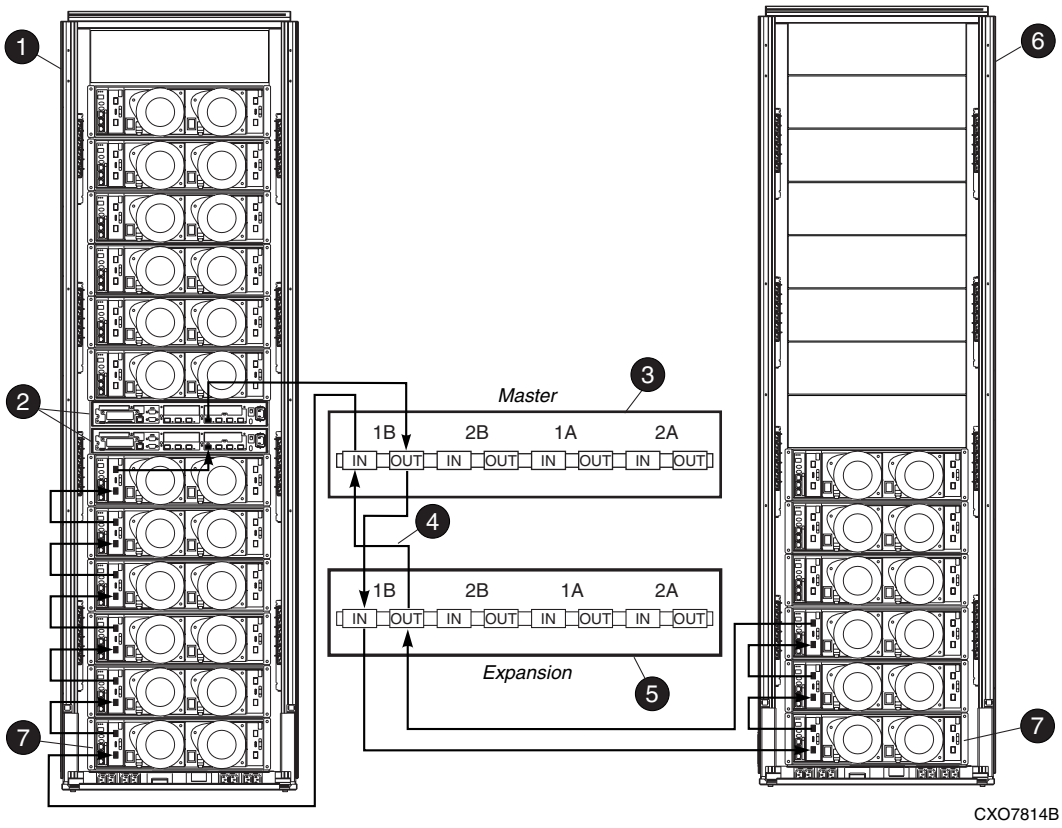


Figure 3.40. 2C12D + 0C6D configuration—Fibre Channel Loop 1B with expansion panels

Figure 3.41 shows Fibre Channel Loop 2A with expansion panels.

Callouts:

1. Master rack
2. Controller pair
3. Master rack expansion panel
4. 5-meter rack-to-rack copper cables
5. Expansion rack expansion panel
6. Expansion rack
7. FC drive enclosure

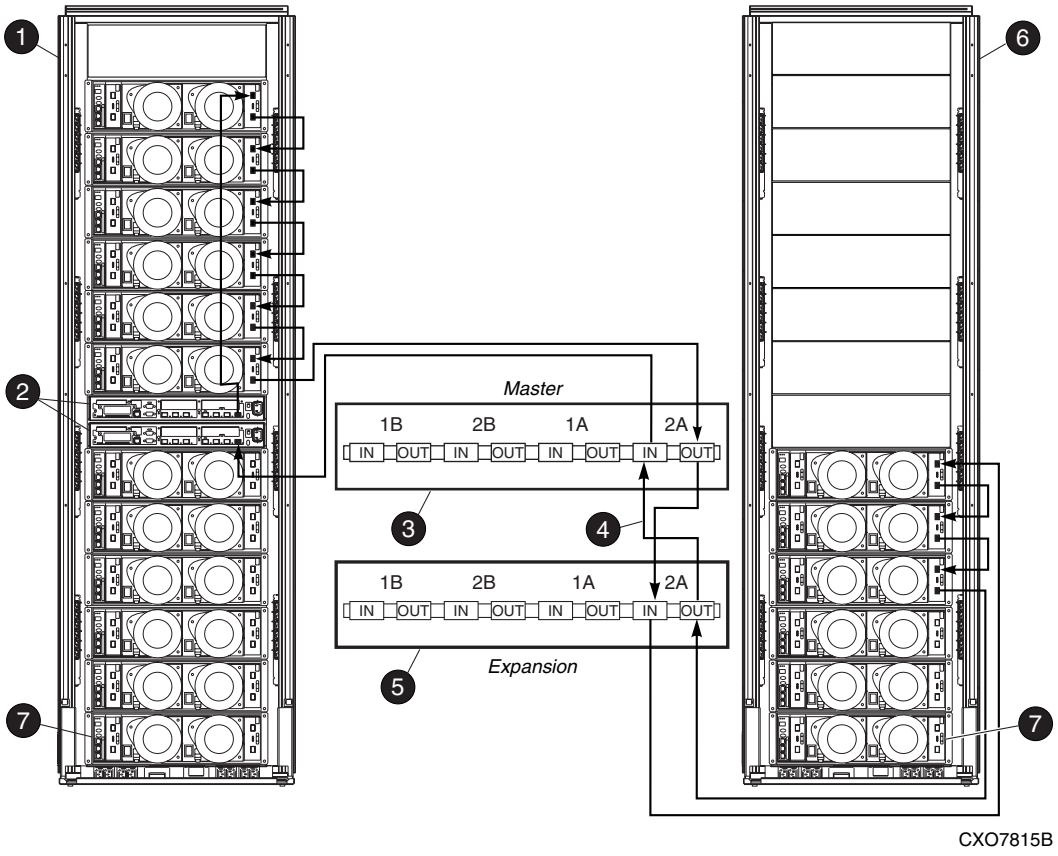


Figure 3.41. 2C12D + 0C6D configuration—Fibre Channel loop 2A with expansion panels

Callouts:

1. Master rack
2. Controller pair
3. Master rack expansion panel
4. 5-meter rack-to-rack copper cables
5. Expansion rack expansion panel
6. Expansion rack
7. FC drive enclosure

Figure 3.42 shows Fibre Channel Loop 2B with expansion panels.

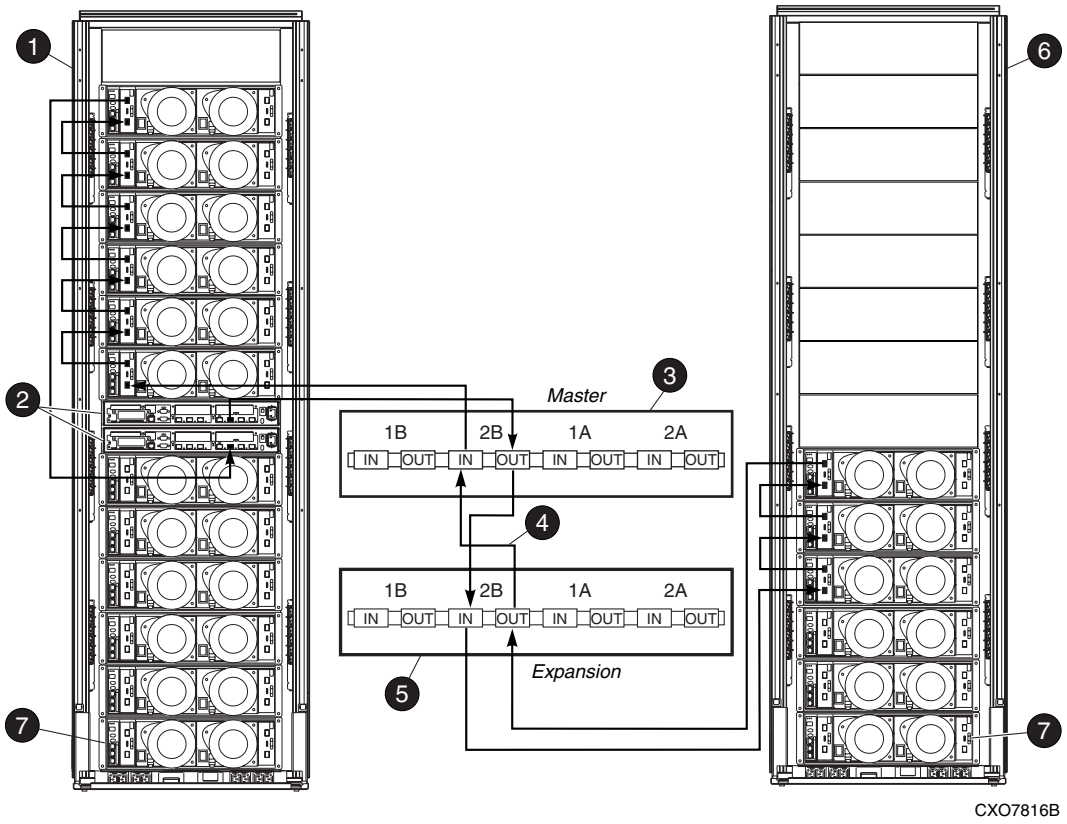


Figure 3.42. 2C12D + 0C6D configuration—Fibre Channel loop 2B with expansion panels

Callouts:

1. Master rack
2. Controller pair
3. Master rack expansion panel
4. 5-meter rack-to-rack copper cables
5. Expansion rack expansion panel
6. Expansion rack
7. FC drive enclosure

2 x 2C12D + 0C12D configuration

The 2 x 2C12D + 0C12D configuration is a triple-rack configuration that can provide up to 144 TB of storage capacity by expanding each Enterprise Virtual Array to 240 disks each for a

total of 480 disks (Table 3.3). The two 2C12D master racks connect to the 0C12D expansion rack with enclosure address bus and copper cables.

Table 3.3. Maximum Storage Capacities for the 2x2C12D + 0C12D

Disk Size	Maximum Capacity
36.4 GB	17.5 TB
72.8 GB	34.9 TB
146 GB	70 TB
250 GB	120 TB
300 GB	144 TB

Enclosure address bus configuration

Each rack contains enclosure address bus junction boxes at 6U increments in the left rear rail of the rack. The 0C12D rack contains six enclosure address bus junction boxes. The FC drive enclosures in the 0C12D rack use all six enclosure address bus junction boxes. The 2C12D rack contains seven enclosure address bus junction boxes. The FC drive enclosures and controller pair in the 2C12D rack use all seven enclosure address bus junction boxes.

The three racks are connected by two enclosure address bus cables. Each master rack is connected to the expansion rack by one enclosure address bus cable. One master rack runs an enclosure address bus cable to the bottom enclosure address bus junction box on the expansion rack; the other master rack runs an enclosure address bus cable to the fourth enclosure address bus junction box (from the bottom) on the expansion rack.

The enclosure address bus cables are polarized. The P1 end of the cable connects to the bottom enclosure address bus junction box on the 2C12D rack. The P2 end of the cable connects to the enclosure address bus junction box on the expansion rack.

Note

Make sure the P1 end of the enclosure address bus cable is plugged into the 2C12D rack and the P2 end of the enclosure address bus cable is plugged into the expansion rack. If the cable is connected to the racks incorrectly, Command View EVA places the FC drive enclosures in the Unmappable Hardware folder.

In order to connect the racks with an enclosure address bus cable, the HP authorized service representative will have to remove the bottom terminator on the master racks (2C12D rack).

Figure 3.43 shows the enclosure address bus cable configuration in the 2C12D + 0C12D configuration.

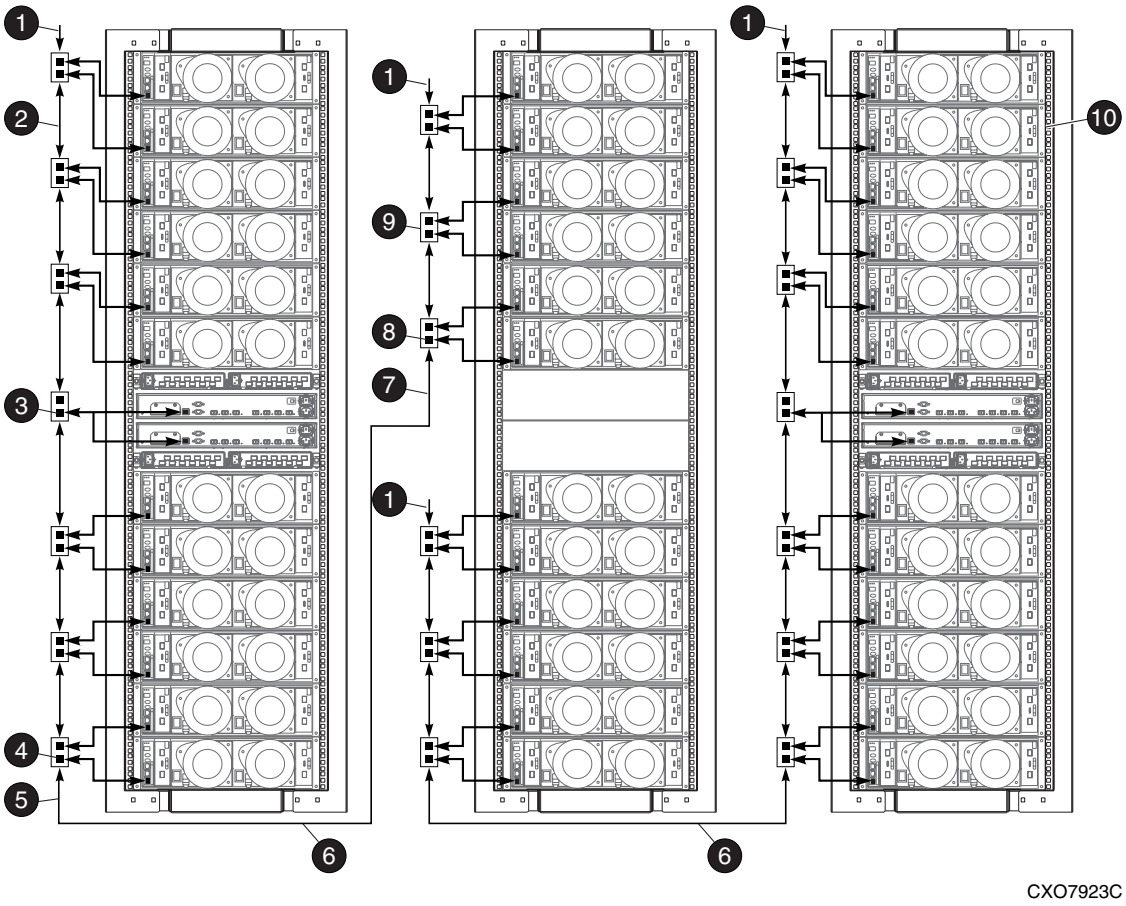


Figure 3.43. 2 x 2C12D + 0C12D configuration—enclosure address bus cables

Callouts:

1. Top terminator
2. Enclosure address bus cable
3. Enclosure address 7
4. Enclosure address 1
5. P1 end of rack-to-rack enclosure address bus cable
6. 5-meter rack-to-rack enclosure address bus cable
7. P2 end of rack-to-rack enclosure address bus cable
8. Enclosure address 15
9. Enclosure address junction box
10. FC drive enclosure

Fibre Channel loop configurations

The 2 x 2C12D + 0C12D configuration contains eight Fibre Channel loops. A Fibre Channel loop is formed when the FC drive enclosures and the controller pair are connected by copper

cables. The 2 x 2C12D + 0C12D configuration can use an FC loop switch or expansion panels to achieve the desired Fibre Channel loop configuration.

The 0C12D rack is divided into an upper and lower half. The upper half of the 0C12D rack connects to the master rack on the right (when viewed from the rear), and the lower half of the 0C12D rack connects to the master rack on the left (when viewed from the rear).

When the 2 x 2C12D + 0C12D configuration uses FC loop switches, each FC drive enclosure in a loop is directly connected to the associated FC loop switch. The controller pair is also connected directly to the associated FC loop switch. When the FC loop switch is powered on, it completes a Fibre Channel loop.

When the 2 x 2C12D + 0C12D configuration uses expansion panels, all of the FC drive enclosures in a loop are connected to the controller pair in the master rack. The 2 x 2C12D + 0C12D configuration uses expansion panels to achieve this configuration.

Refer toTable 3.1 for locations of Fibre Channel loops in a storage rack.

Figure 3.44 shows the two 1A Fibre Channel loops and the associated FC loop switches.

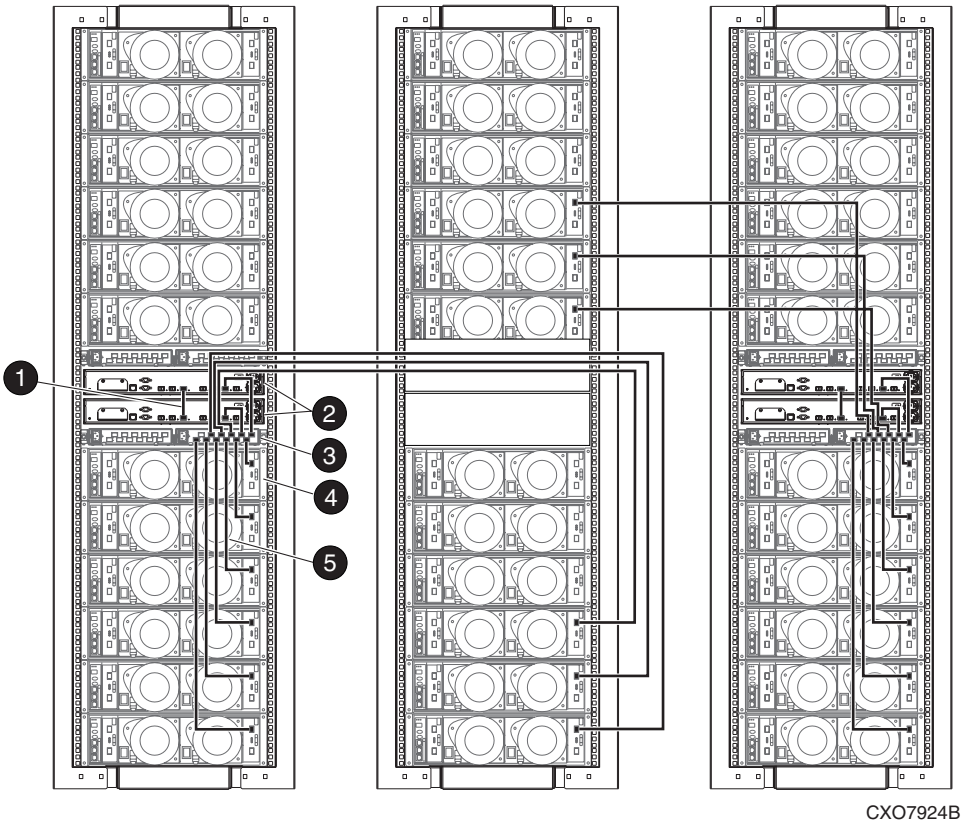


Figure 3.44. 2 x 2C12D + 0C12D configuration—Fibre Channel loop 1A with FC loop switch

Callouts:

1. Controller-to-controller mirror port FC cable
2. Controller pair
3. FC loop switch

4. FC drive enclosure
5. Fibre Channel cable

Figure 3.45 shows the two 1B Fibre Channel loops and the associated FC loop switches.

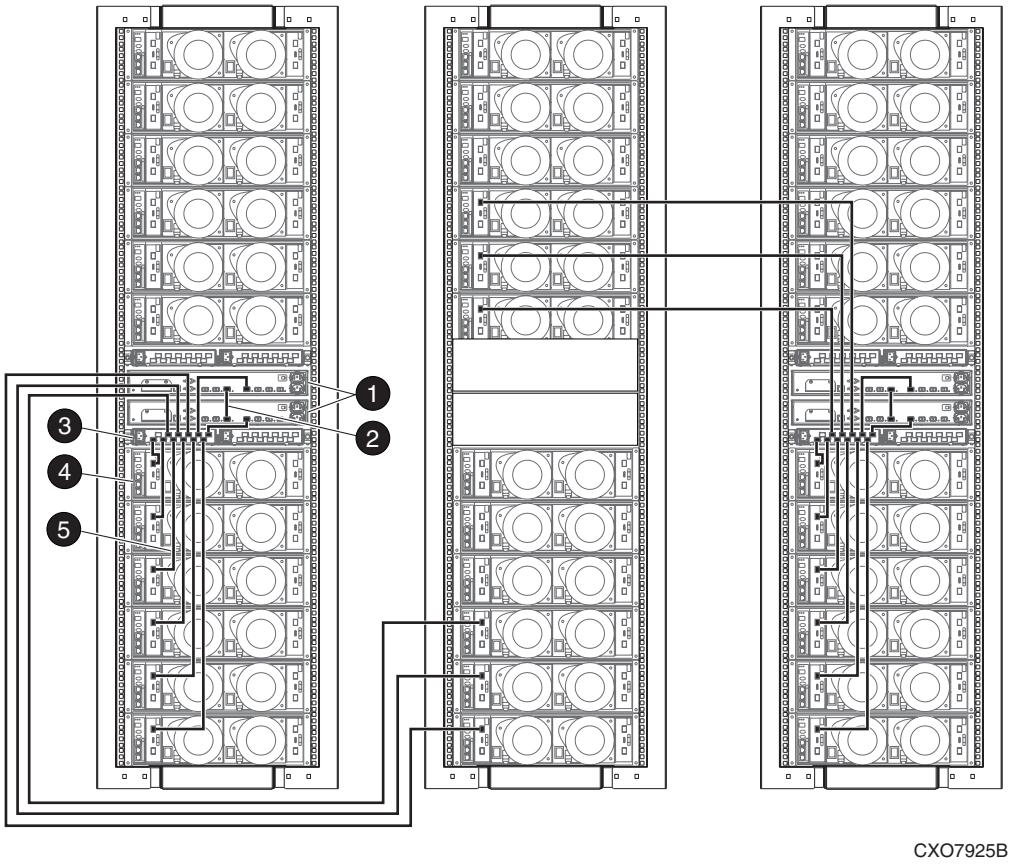


Figure 3.45. 2 x 2C12D + 0C12D configuration—Fibre Channel loop 1B with FC loop switch

Callouts:

1. Controller pair
2. Controller-to-controller Mirror port FC cable
3. FC loop switch
4. FC drive enclosure
5. Fibre Channel cable

Figure 3.46 shows the two 2A Fibre Channel loops and the associated FC loop switches.

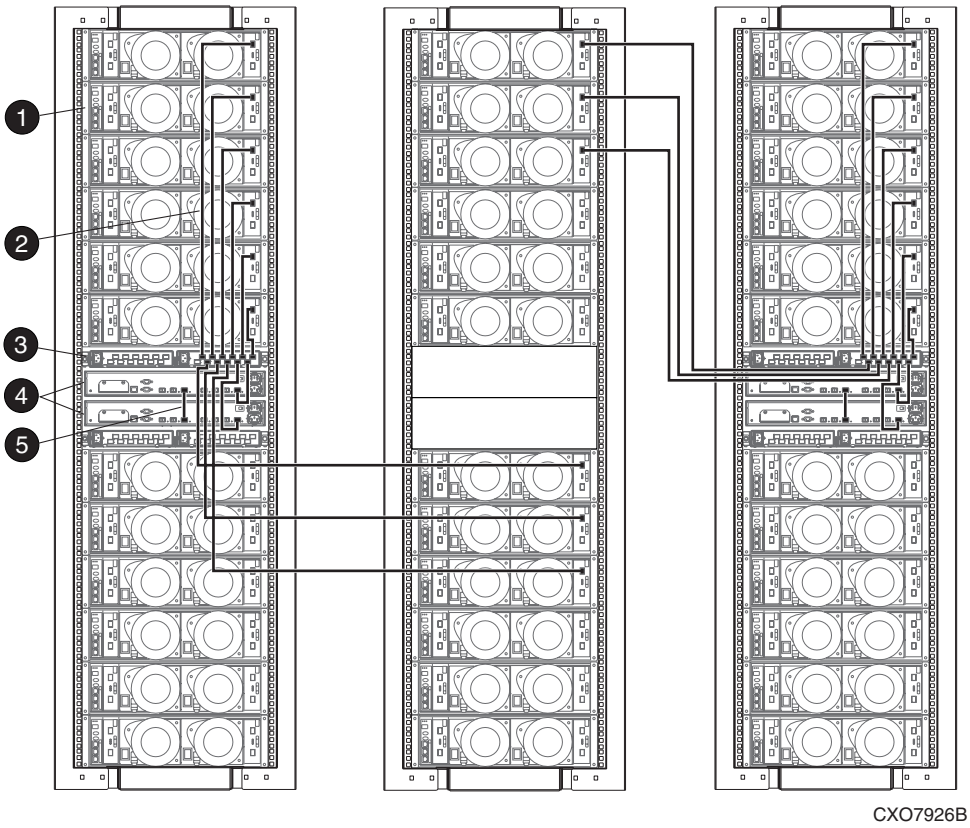


Figure 3.46. 2 x 2C12D + 0C12D configuration—Fibre Channel loop 2A with FC loop switch

Callouts:

1. FC drive enclosure
2. Fibre Channel cable
3. FC loop switch
4. Controller pair
5. Controller-to-controller mirror port FC cable

Figure 3.47 shows the two 2B Fibre Channel loops and the associated FC loop switches.

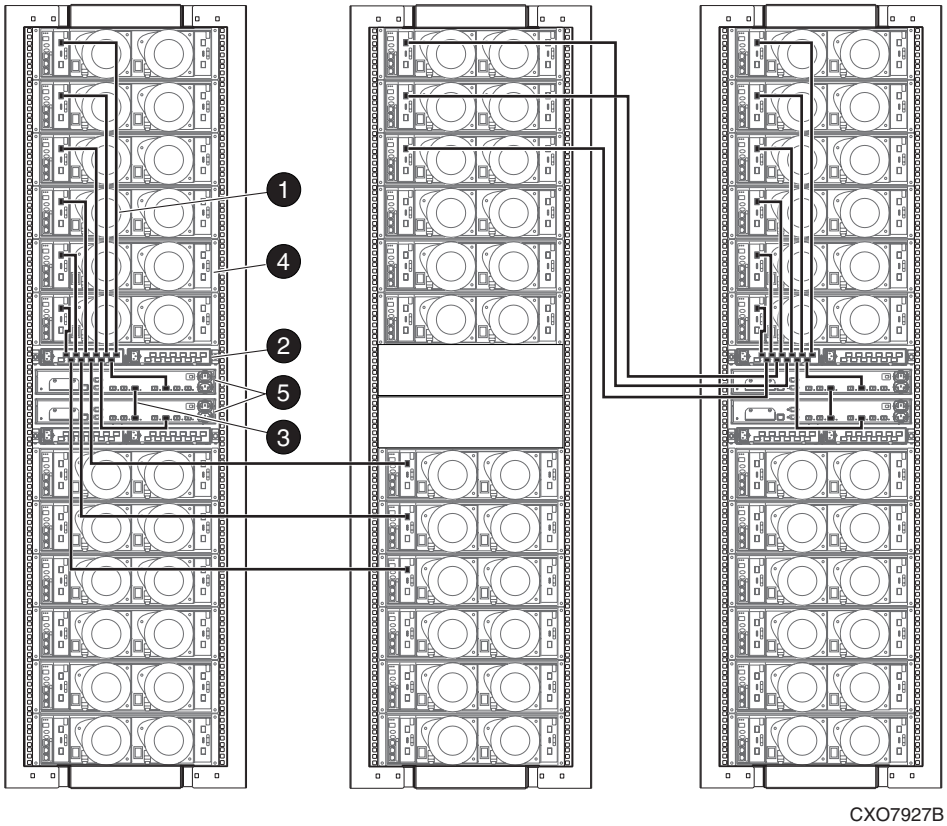


Figure 3.47. 2 x 2C12D + 0C12D configuration—Fibre Channel loop 2B with FC loop switch

Callouts:

1. Fibre Channel cable
2. FC loop switch
3. Controller-to-controller mirror port FC cable
4. FC drive enclosure
5. Controller pair

Figure 3.48 shows the two 1A Fibre Channel loops with expansion panels.

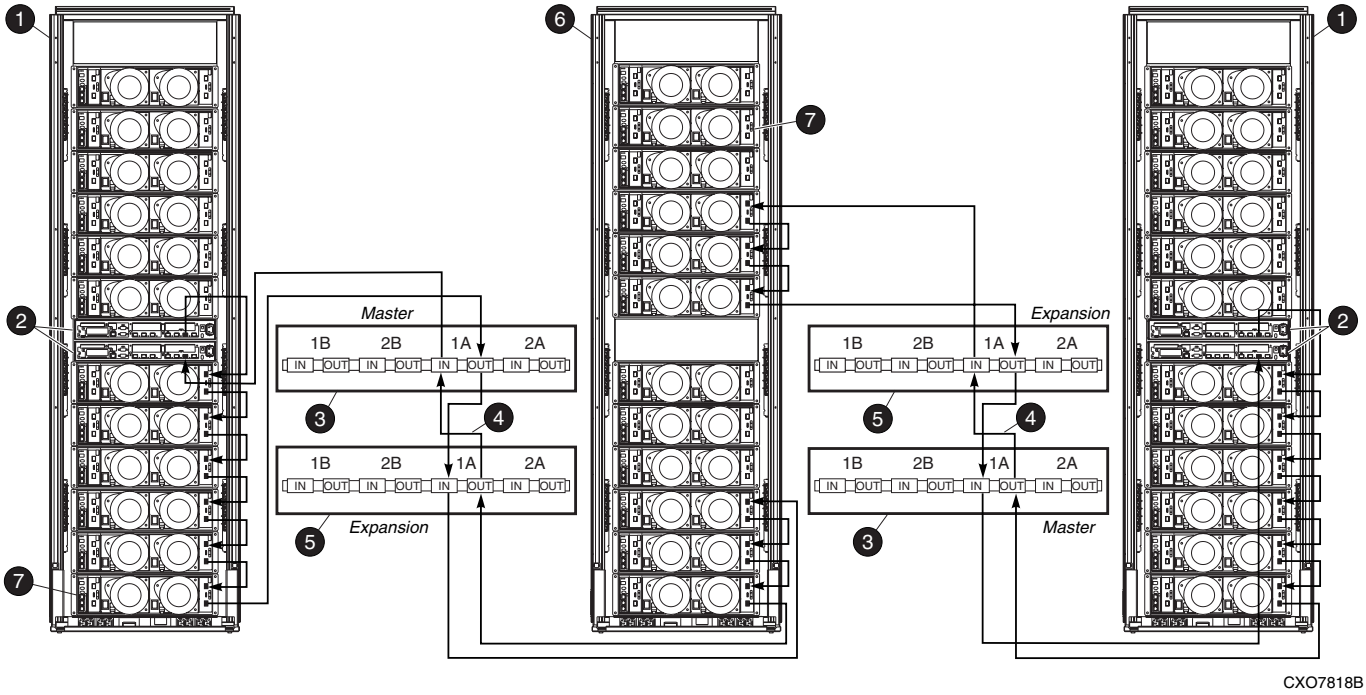


Figure 3.48. 2 x 2C12D + 0C12D configuration—Fibre Channel loop 1A with expansion panels

Callouts:

1. Master rack
2. Controller pair
3. Master rack expansion panel
4. 5–meter rack-to-rack copper cables
5. Expansion rack expansion panels
6. Expansion rack
7. FC drive enclosure

Figure 3.49 shows the two 1B Fibre Channel loops with expansion panels.

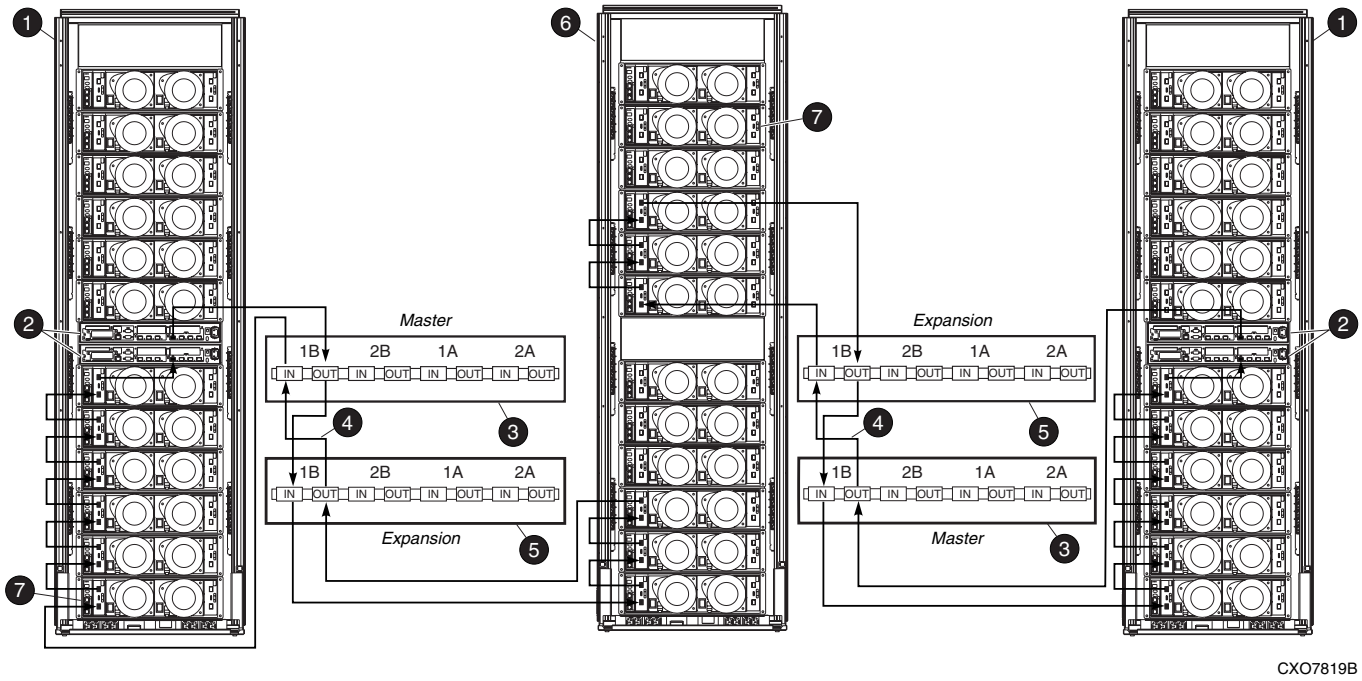


Figure 3.49. 2 x 2C12D + 0C12D configuration—Fibre Channel loop 1B with expansion panels

Callouts:

1. Master rack
2. Controller pair
3. Master rack expansion panel
4. 5–meter rack-to-rack expansion panel
5. Expansion rack expansion panel
6. Expansion rack
7. FC drive enclosure

Figure 3.50 shows the two 2A Fibre Channel loops with expansion panels.

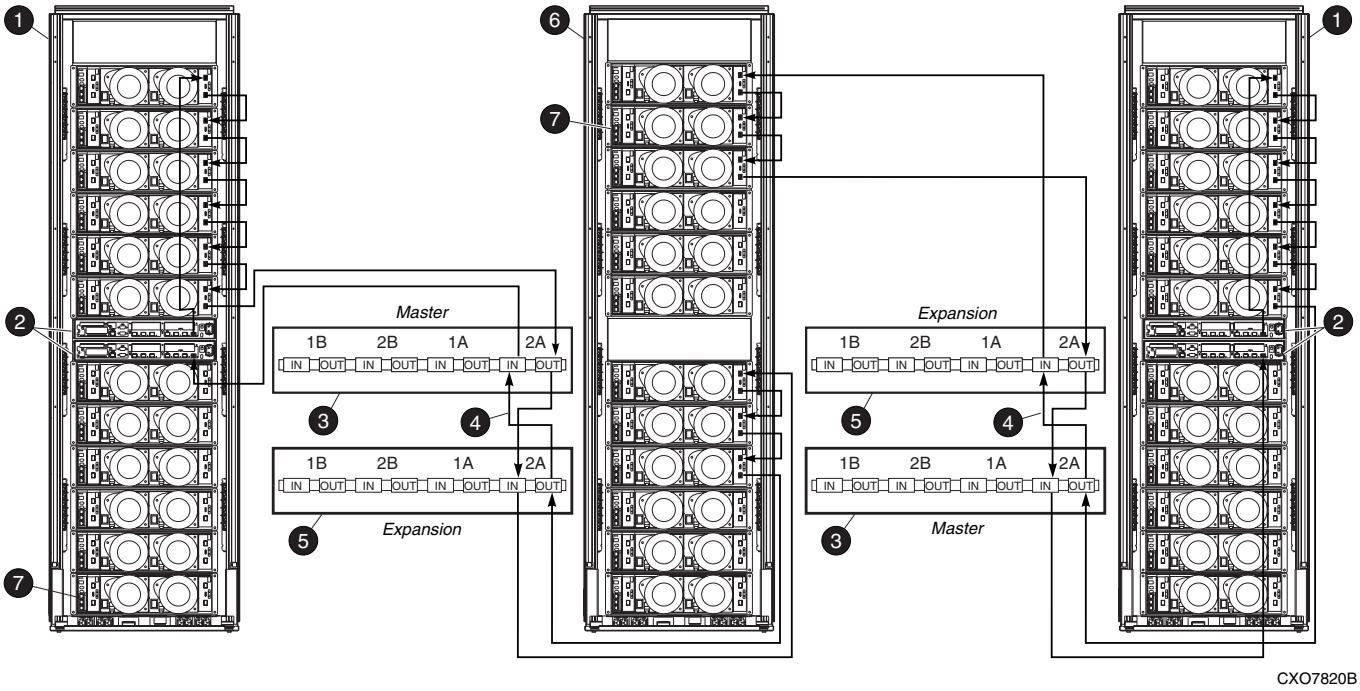


Figure 3.50. 2 x 2C12D + 0C12D configuration—Fibre Channel loop 2A with expansion panels

Callouts:

1. Master rack
2. Controller pair
3. Master rack expansion panel
4. 5–meter rack-to-rack expansion panel
5. Expansion rack expansion panel
6. Expansion rack
7. FC drive enclosure

Figure 3.51 shows the two 2B Fibre Channel loops with expansion panels.

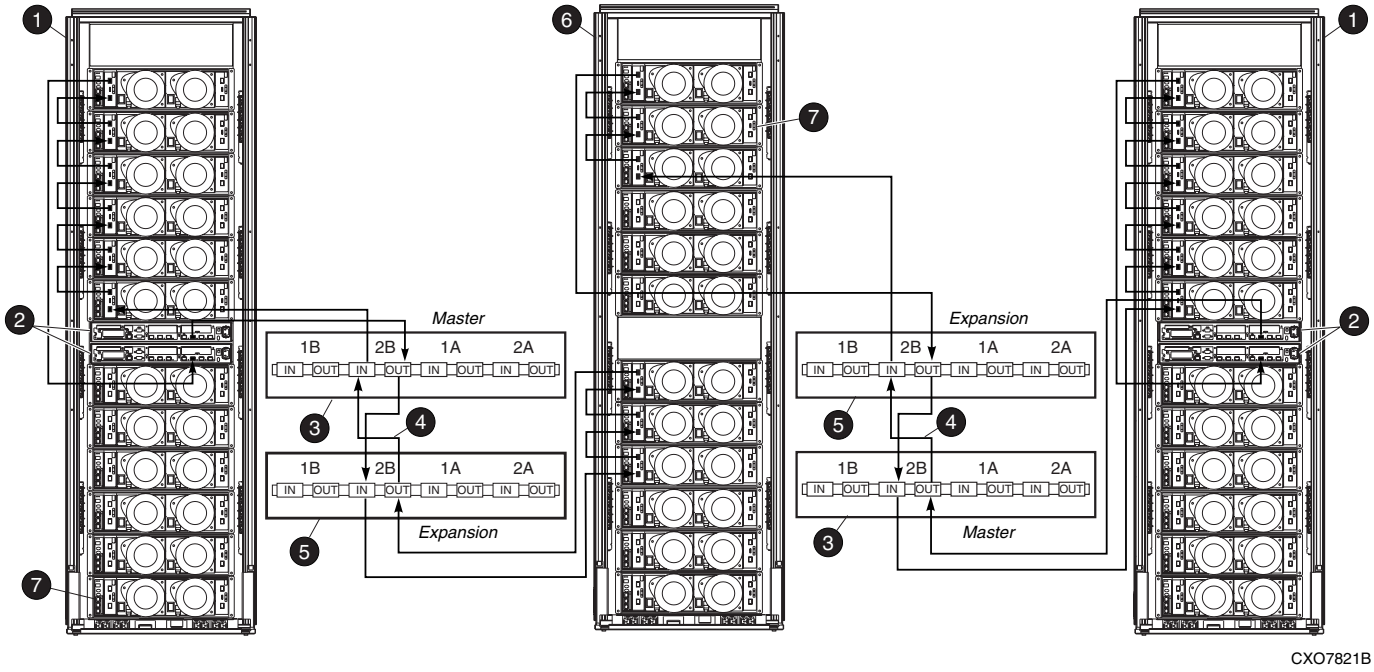


Figure 3.51. 2 x 2C12D + 0C12D configuration—Fibre Channel loop 2B with expansion panels

Callouts:

1. Master rack
2. Controller pair
3. Master rack expansion panel
4. 5–meter rack-to-rack expansion panel
5. Expansion rack expansion panel
6. Expansion rack
7. FC drive enclosure

Chapter 4. Enterprise Virtual Array 3000 Configurations

This chapter briefly discusses the standard Enterprise Virtual Array 3000 configuration. Each section describes the placement of HSV controllers, drive enclosures, enclosure address bus junction boxes and cables, and copper Fibre Channel cables.

This chapter contains the following sections:

2C1D configuration

The 2C1D configuration is a single-rack configuration that provides a maximum storage capacity of 2.0 TB (Table 4.1). This configuration can contain a maximum of 14 disks. You can expand the capacity of the 2C1D configuration by adding up to three FC drive enclosures.

The 2C1D configuration is available in a 42U rack.

Table 4.1. Maximum Storage Capacity for the 2C1D Configuration

Disk Size	Maximum Capacity
36.4 GB	0.5 TB
72.8 GB	1.0 TB
146 GB	2.0 TB
250 GB	3.5 TB
300 GB	4.2 TB

Enclosure address bus configurations

The 2C1D configuration contains three enclosure address bus junction boxes at 6U increments in the left rear rail of the rack. Each FC drive enclosure should be connected to an enclosure address bus junction box. The FC drive enclosures connect to each enclosure address bus junction box in pairs. The HSV controller pair connects to the enclosure address bus junction boxes with a Y cable. Figure 4.4 shows the enclosure address bus cable configuration for the 2C1D configuration.

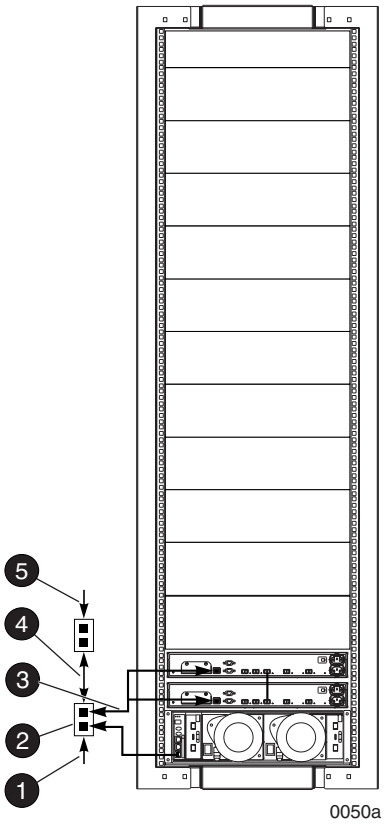


Figure 4.1. 2C1D configuration—enclosure address bus cables

Callouts:

1. Bottom terminator
2. Enclosure address bus junction box
3. Y cable
4. Enclosure address bus cable
5. Top terminator

Fibre channel loop configurations

The 2C1D configuration contains two copper cable loops. A loop is formed when the FC drive enclosures and the HSV controller pair are connected by cables.

Table 4.2 provides the locations for the cable loops in a storage rack.

Table 4.2. Fibre Channel Loop Locations in Rack

Loop	Location in Rack (Viewed from Rear)
1A	Lower right side
1B	Lower left side

Figure 4.2 shows loop 1A, and Figure 4.3 shows loop 1B.

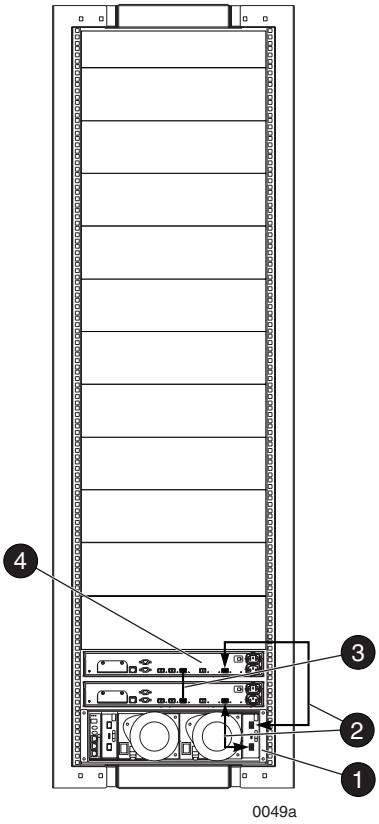


Figure 4.2. 2C1D configuration—loop 1A

Callouts:

1. FC drive enclosure
2. Copper FC cables
3. Controller-to-controller mirror port cable
4. HSV100 controller

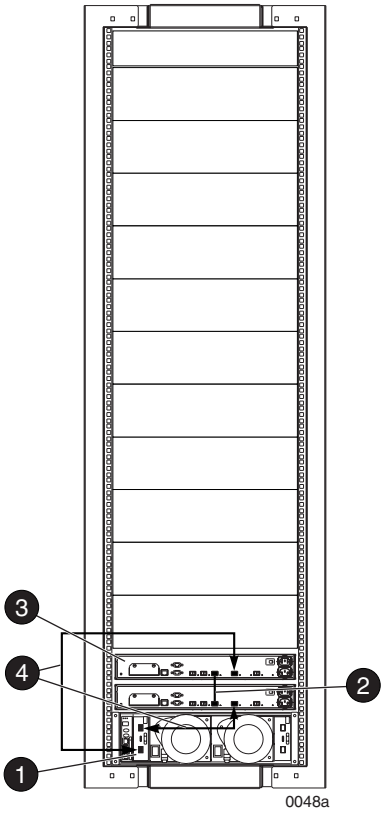


Figure 4.3. 2C1D configuration—loop 1B

Callouts:

1. FC drive enclosure
2. Controller-to-controller mirror port cable
3. HSV110 controller
4. Copper FC cables

2C2D configuration

The 2C2D configuration is a single-rack configuration that provides a maximum storage capacity of 8.4 TB (Table 4.3). This configuration can contain a maximum of 28 disks. You can expand the capacity of the 2C2D configuration by adding up to two FC drive enclosures.

The 2C2D configuration is available in a 42U rack.

Table 4.3. Maximum Storage Capacity for the 2C2D Configuration

Disk Size	Maximum Capacity
36.4 GB	1.0 TB
72.8 GB	2.0 TB
146 GB	4.1 TB
250 GB	7.0 TB
300 GB	8.4 TB

Enclosure address bus configuration

The 2C2D configuration contains three enclosure address bus junction boxes at 6U increments in the left rear rail of the rack. Each FC drive enclosure should be connected to an enclosure address bus junction box. The FC drive enclosures connect to each enclosure address bus junction box in pairs. The HSV controller pair connects to the enclosure address bus junction boxes with a Y cable. Figure 4.4 shows the enclosure address bus cable configuration for the 2C2D configuration.

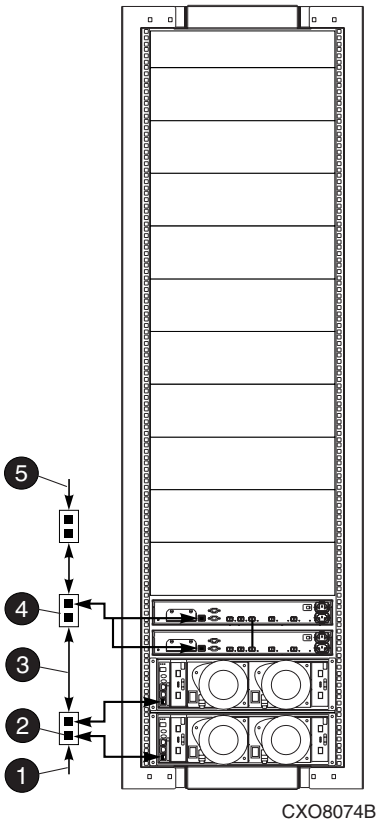


Figure 4.4. 2C2D configuration—enclosure address bus cables

Callouts:

1. Bottom terminator
2. Enclosure address 1
3. Enclosure address bus cable
4. Enclosure address junction box
5. Top terminator

Fibre channel loop configurations

The 2C2D configuration contains two copper cable loops. A loop is formed when the FC drive enclosures and the HSV controller pair are connected by cables.

Table 4.2 provides the locations for the cable loops in a storage rack.

Figure 4.5 shows loop 1A.

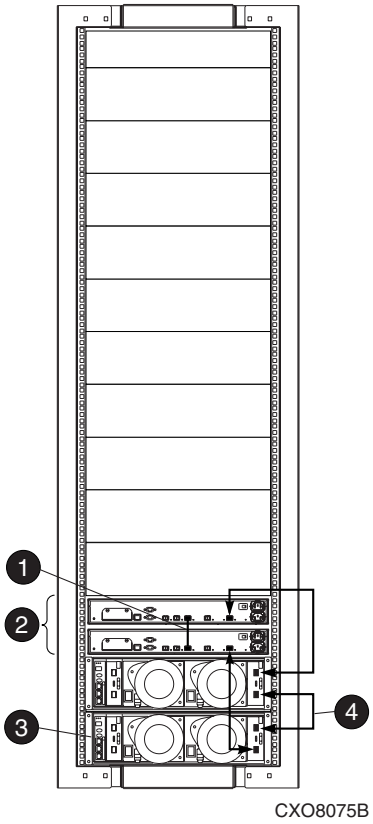


Figure 4.5. 2C2D configuration—loop 1A

Callouts:

1. Controller-to-controller Mirror port cable
2. HSV100 controller pair
3. FC drive enclosure
4. Copper cable

Figure 4.6 shows loop 1B

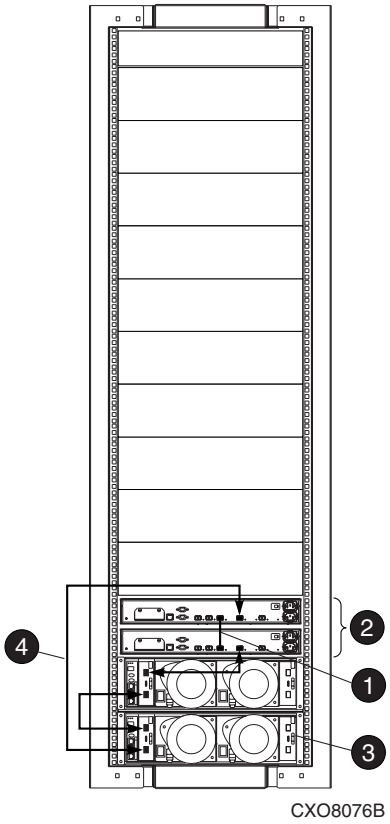


Figure 4.6. 2C2D configuration—loop 1B

Callouts:

1. Controller-to-controller Mirror port cable
2. HSV100 controller pair
3. FC drive enclosure
4. Copper cable

Chapter 5. Enterprise Virtual Array 5000 Rack Expansion

This chapter summarizes how to add new FC drive enclosures to an Enterprise Virtual Array 5000 storage rack and describes the placement of controllers, FC drive enclosures, FC loop switches, enclosure address bus junction boxes and cables, and copper cables.

This chapter contains the following sections:

Only HP authorized service representatives may expand the 2C6D and 0C6D racks. The 2C6D and 0C6D racks may be expanded by adding FC drive enclosures, copper cables, and enclosure address bus cables to the existing racks. In general, the FC drive enclosures are added in pairs.

- 2C6D + 2D (expands the 2C6D rack to 112 disks)
- 2C6D + 4D (expands the 2C6D rack to 140 disks)
- 2C6D + 6D (expands the 2C6D rack to 168 disks)

The 0C6D rack can be expanded to the 0C12D rack.

Adding FC drive enclosures to a rack

An HP authorized service representative can add FC drive enclosures to a rack while the Enterprise Virtual Array is on or off. HP highly recommends that the Enterprise Virtual Array is turned off while adding FC drive enclosures to a rack. If the HP authorized service representative would like to add an FC drive enclosure to the rack with the power on, the service representative should take care to disconnect and connect one Fibre Channel loop at a time.

Adding FC drive enclosures involves placing the drive enclosures in the rack, connecting the drive enclosures to the enclosure address bus and the power outlets, and correctly adding the drive enclosures to the FC loops.

Note

An HP authorized service representative must add the FC drive enclosures to the rack. Do not attempt to add an FC drive enclosure without first seeking guidance and assistance from an HP authorized service representative.

2C6D configuration

The 2C6D configuration contains up to six FC drive enclosures (84 disks). This configuration is shown in Figure 5.1.

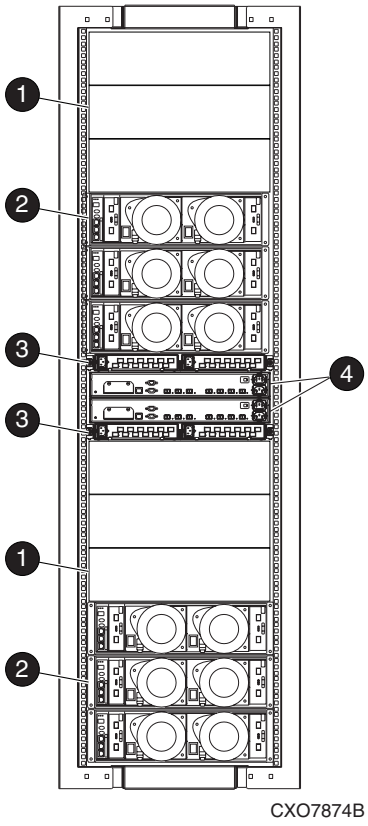


Figure 5.1. 2C6D configuration

Callouts:

1. 3U blank
2. FC drive enclosure
3. FC loop switch
4. Controller pair

2C6D + 6D configuration

The 2C6D + 6D configuration provides up to twelve FC drive enclosures (168 disks). It upgrades a 2C6D configuration to a 2C12D configuration.

Note

This configuration is available only with assistance from an HP Authorized Service Representative.

Enclosure address bus configuration

Each FC drive enclosure should be connected to an enclosure address bus junction box. The FC drive enclosures connect to each enclosure address bus junction box in pairs. The controller pair connects to the enclosure address bus junction box with a Y cable. Figure 5.2 shows the enclosure address bus cable configuration for the 2C6D + 6D configuration.

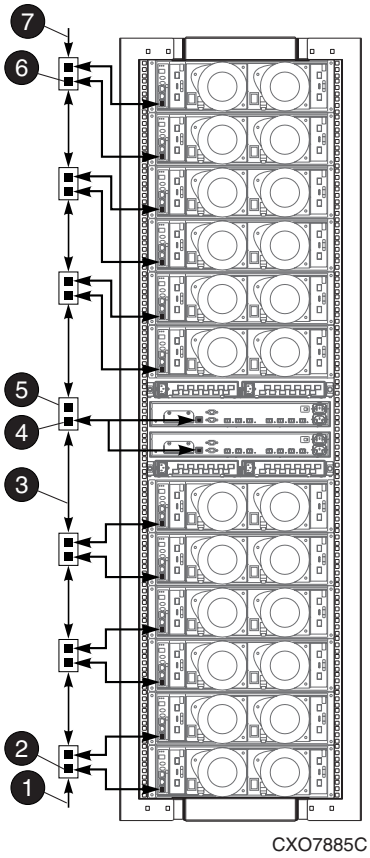


Figure 5.2. 2C6D + 6D configuration—enclosure address cables

Callouts:

1. Bottom terminator
2. Enclosure address 1
3. Enclosure address bus cable
4. Enclosure address 7
5. Enclosure address bus junction box
6. Enclosure address 13
7. Top terminator

Fibre channel loop configurations

The 2C6D + 6D configuration contains four Fibre Channel loops. A Fibre Channel loop is formed when the FC drive enclosures and the controller pair are connected by copper cables. The 2C6D + 6D configuration can use an FC loop switch or an expansion panel to achieve the desired Fibre Channel loop configuration.

When the 2C6D + 6D configuration uses FC loop switches, each FC drive enclosure in a loop is directly connected to the associated FC loop switch. The controller pair is also connected directly to the associated FC loop switch. When the FC loop switch is powered on, it completes a Fibre Channel loop.

When the 2C6D + 6D configuration uses an expansion panel, a Fibre Channel loop is accomplished by connecting two FC drive enclosures directly to the controllers and linking each FC drive enclosure together in a chain.

Table 5.1 provides the locations for the Fibre Channel loops in a storage rack.

Table 5.1. Fibre Channel Loop Locations in Rack

Fibre Channel Loop	Location in Rack (viewed from rear)
1A	Lower right side
1B	Lower left side
2A	Upper right side
2B	Upper left side

Figure 5.3 shows Fibre Channel loop 1A and the associated FC loop switch.

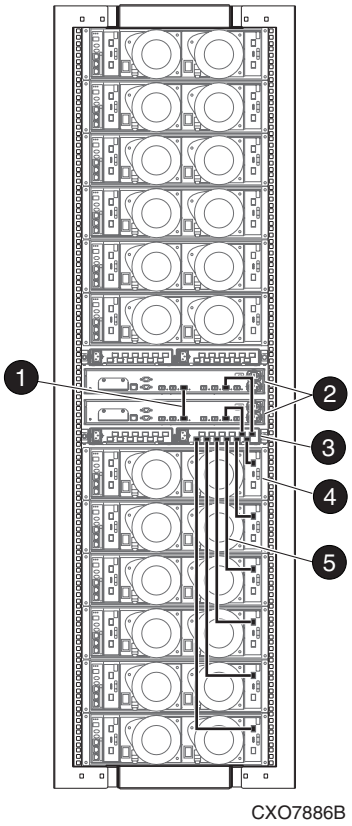


Figure 5.3. 2C6D + 6D configuration—Fibre Channel loop 1A with FC loop switch

Callouts:

1. Controller-to-controller mirror port FC cable
2. Controller pair
3. FC loop switch
4. FC drive enclosure
5. Fibre Channel cable

Figure 5.4 shows Fibre Channel loop 1B and the associated FC loop switch.

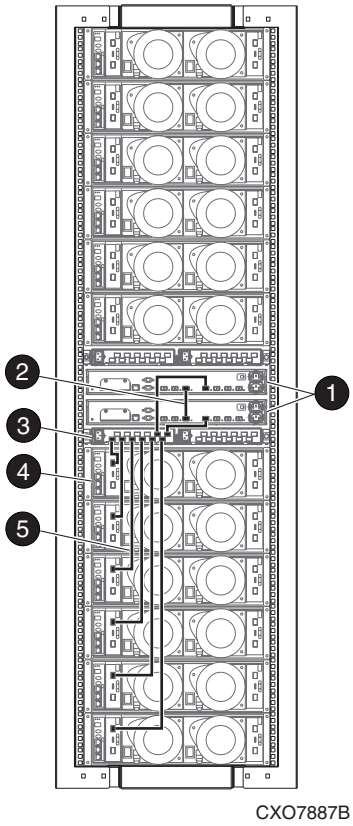


Figure 5.4. 2C6D + 6D configuration—Fibre Channel loop 1B with FC loop switch

Callouts:

1. Controller pair
2. Controller-to-controller mirror port FC cable
3. FC loop switch
4. FC drive enclosure
5. Fibre Channel cable

Figure 5.5 shows Fibre Channel loop 2A and the associated FC loop switch.

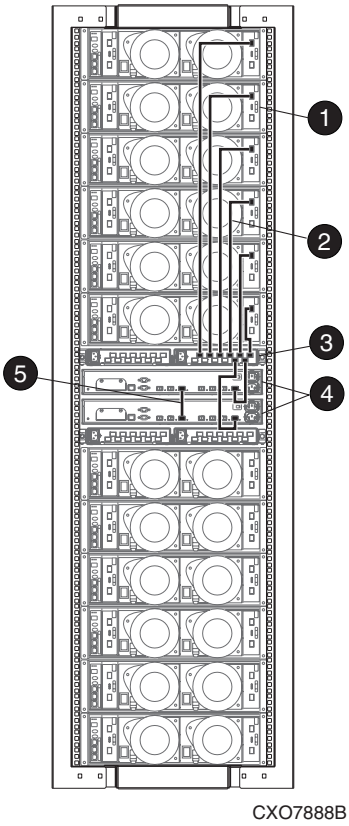


Figure 5.5. 2C6D + 6D configuration—Fibre Channel loop 2A with FC loop switch

Callouts:

1. FC drive enclosure
2. Fibre Channel cable
3. FC loop switch
4. Controller pair
5. Controller-to-controller mirror port FC cable

Figure 5.6 shows Fibre Channel loop 2B and the associated FC loop switch.

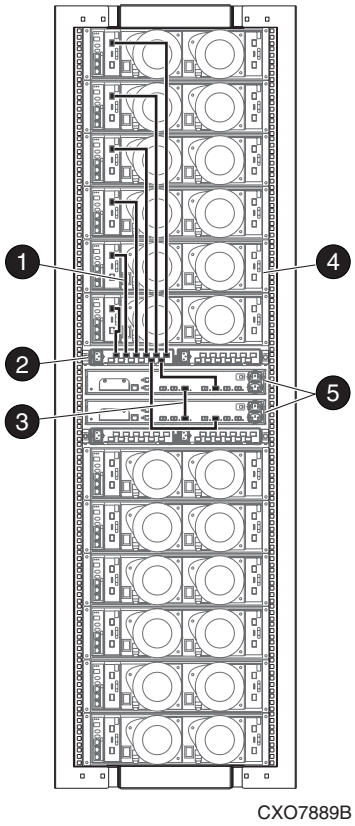


Figure 5.6. 2C6D + 6D configuration—Fibre Channel loop 2B with FC loop switch

Callouts:

1. Fibre Channel cable
2. FC loop switch
3. Controller-to-controller mirror port FC cable
4. FC drive enclosure
5. Controller pair

Figure 5.7 shows Fibre Channel loop 1A with the expansion panel.

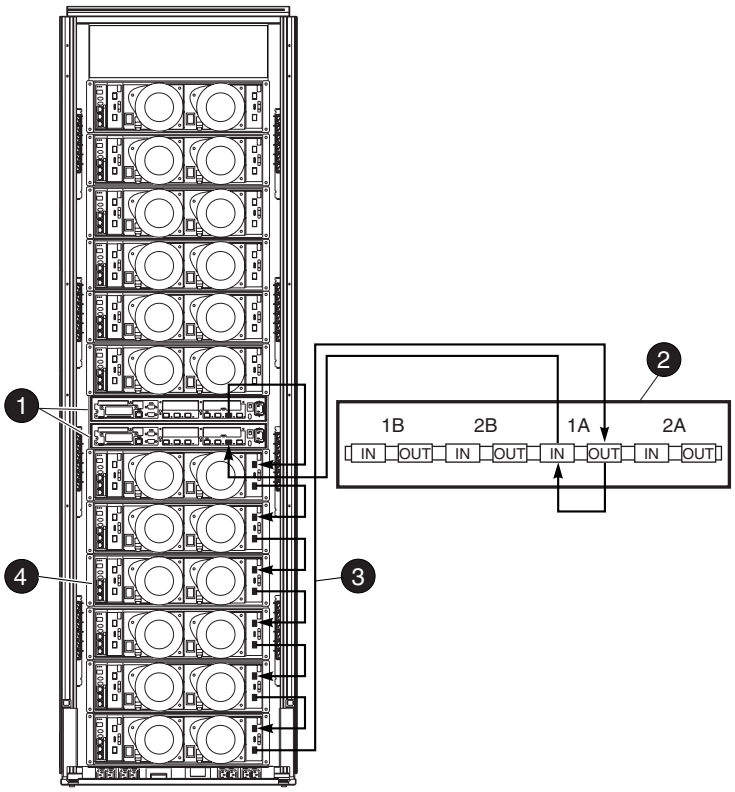


Figure 5.7. 2C6D + 6D configuration—Fibre Channel loop 1A with expansion panel

Callouts:

1. Controller pair
2. Expansion panel
3. Fibre Channel cable
4. FC drive enclosure

Figure 5.8 shows Fibre Channel loop 1B with an expansion panel.

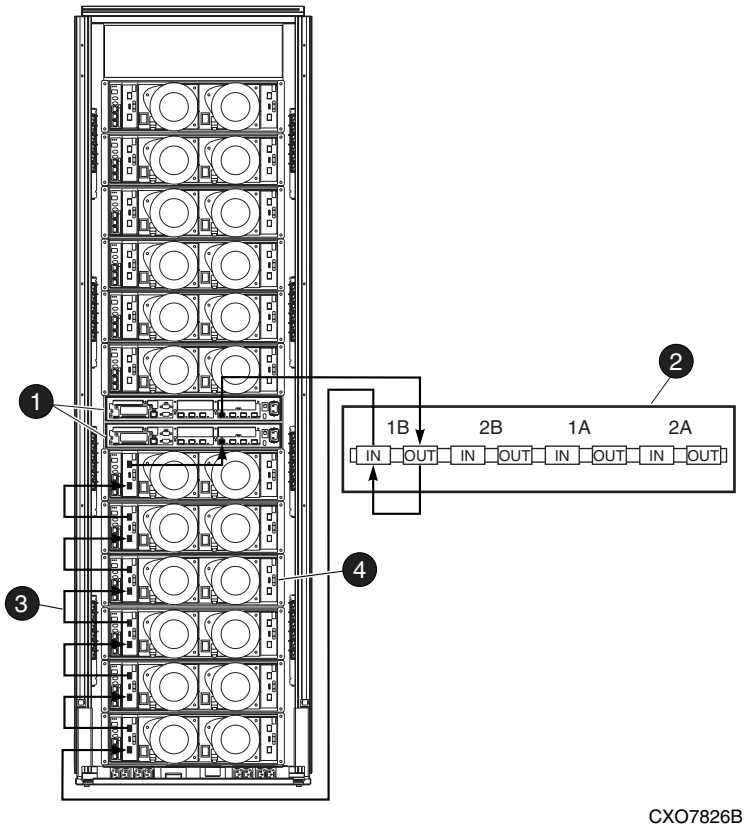


Figure 5.8. 2C6D + 6D configuration—Fibre Channel loop 1B with expansion panel

Callouts:

1. Controller pair
2. Expansion panel

Figure 5.9 shows Fibre Channel loop 2A with an expansion panel.

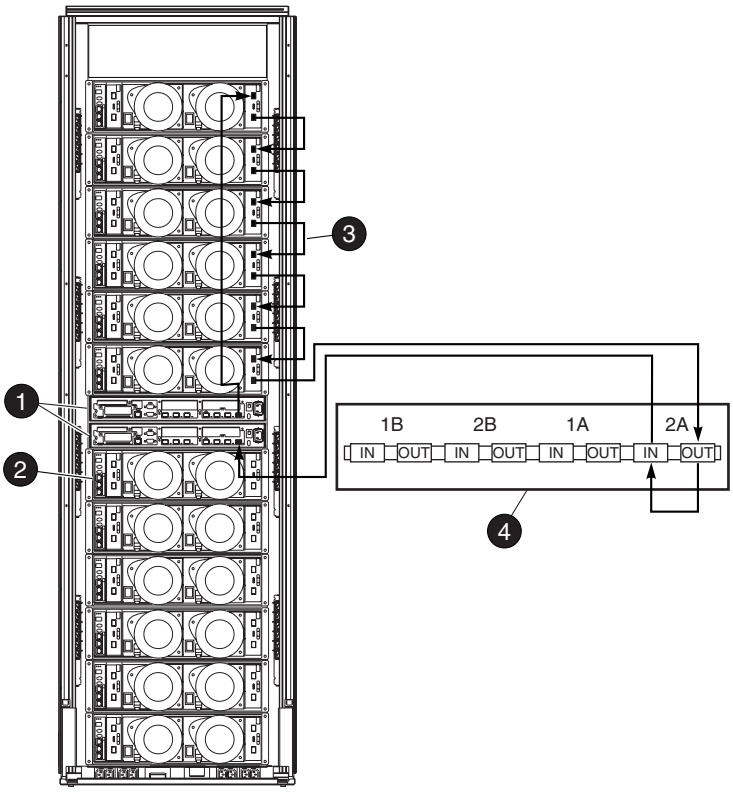


Figure 5.9. 2C6D + 6D configuration—Fibre Channel loop 2A with expansion panel

Callouts:

1. Controller pair
2. FC drive enclosure
3. Fibre Channel cable
4. Expansion panel

Figure 5.10 shows Fibre Channel loop 2B with an expansion panel.

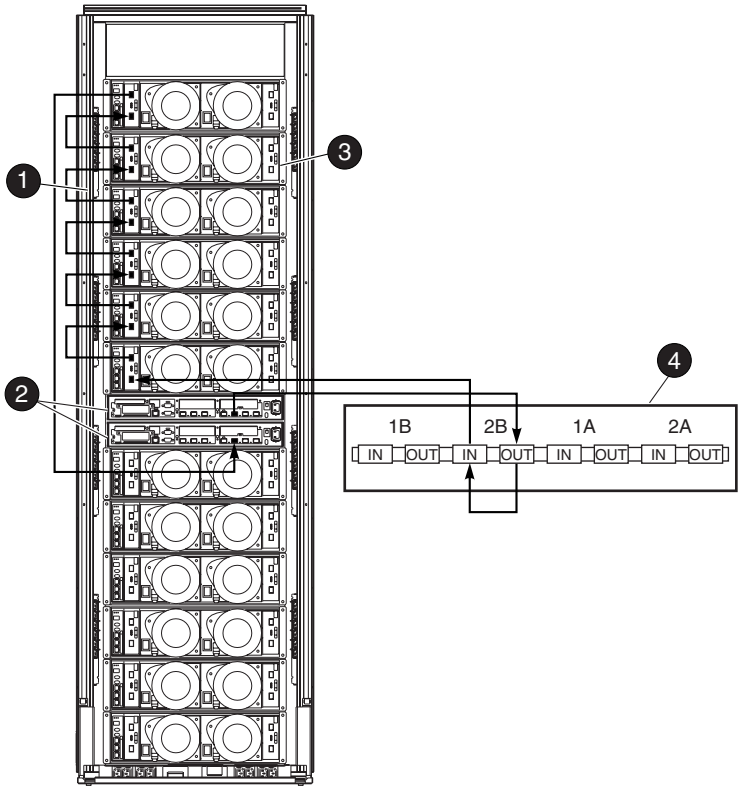


Figure 5.10. 2C6D + 6D configuration—Fibre Channel loop 2B with expansion panel

Callouts:

1. Fibre Channel cable
2. Controller pair
3. FC drive enclosure
4. Expansion panel

0C6D + 6D configuration

The 0C6D + 6D configuration can support two controller pairs and allows each controller pair to support a maximum of 240 disks.

Enclosure address bus configuration

Each FC drive enclosure should be connected to an enclosure address bus junction box. The FC drive enclosures connect to each enclosure address bus junction box in pairs. Figure 5.11 shows the enclosure address bus cable configuration for the 0C6D + 6D configuration.

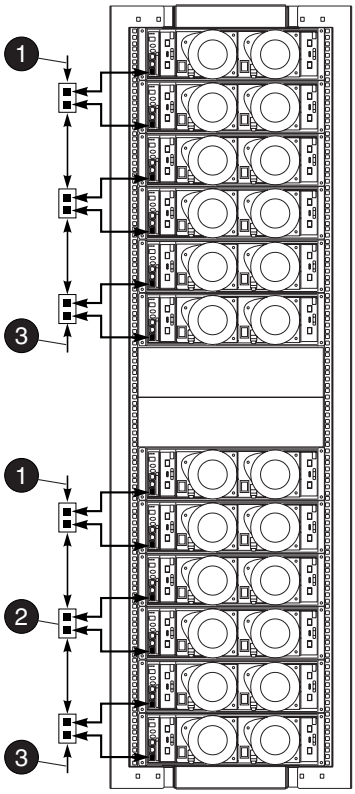


Figure 5.11. 0C6D + 6D configuration—enclosure address bus cables

Callouts:

1. Terminator
2. Enclosure address bus junction box
3. Bottom terminator (this terminator is removed to connect the expansion rack to the master rack)

Fibre channel loop configurations

The 0C6D + 6D configuration contains eight Fibre Channel loops. A Fibre Channel loop is formed when the FC drive enclosures and the controller pair are connected by copper cables. The 0C6D + 6D configuration can use an FC loop switch or expansion panels to achieve the desired Fibre Channel loop configuration.

The 0C6D + 6D rack is divided into an upper and lower half. The upper half of the 0C12D rack connects to one master rack, and the lower half of the 0C12D rack connects to another master rack.

When the 0C6D + 6D configuration uses FC loop switches, each FC drive enclosure in a loop is directly connected to the associated FC loop switch on the master rack. The controller pair is also connected directly to the associated FC loop switch. When the FC loop switch is powered on, it completes a Fibre Channel loop.

When the 0C6D + 6D configuration uses expansion panels, all of the FC drive enclosures in a loop are connected to the controller pair in the master rack. The 0C6D + 6D configuration uses expansion panels to achieve this configuration.

Figure 5.12 shows the two 1A Fibre Channel loops.

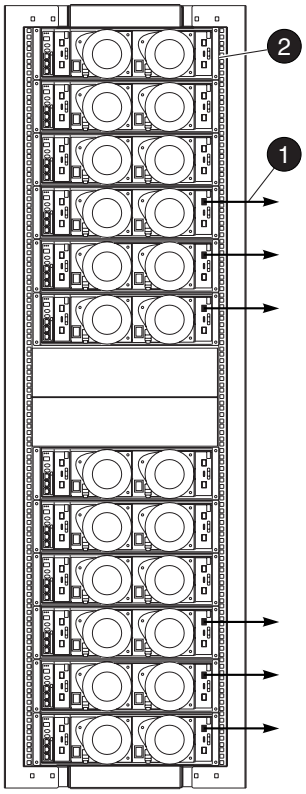


Figure 5.12. 0C6D + 6D configuration—Fibre Channel loop 1A

Callouts:

1. FC cable
   Each FC cable is connected to the 1A FC loop switch in the master rack.

2. FC drive enclosure

Figure 5.13 shows the two 1B Fibre Channel loops.

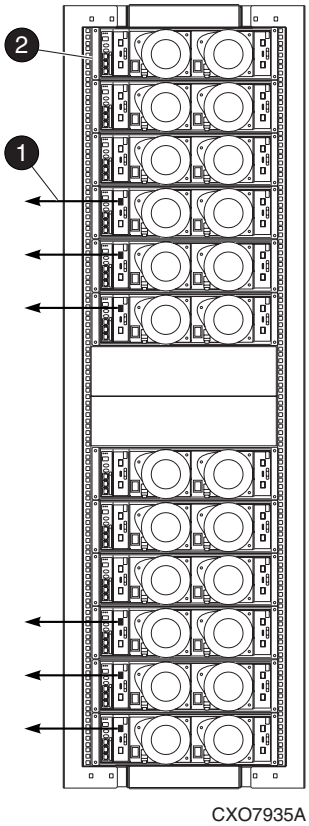


Figure 5.13. 0C6D + 6D configuration—Fibre Channel loop 1B

Callouts:

1. FC cable
   Each FC cable is connected to the 1B FC loop switch in the master rack.
2. FC drive enclosure

Figure 5.14 shows the two 2A Fibre Channel loops.

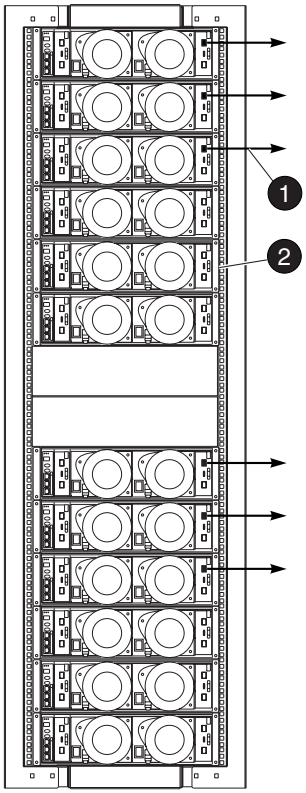


Figure 5.14. 0C6D + 6D configuration—Fibre Channel loop 2A

Callouts:

1. FC cable
   Each FC cable is connected to the 2A FC loop switch in the master rack.
2. FC drive enclosure

Figure 5.15 shows the two 2B Fibre Channel loops.

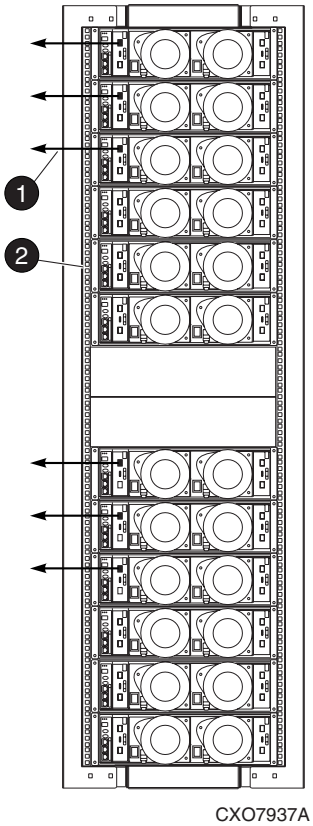


Figure 5.15. 0C6D + 6D configuration—Fibre Channel loop 2B

Callouts:

1. FC cable
   Each FC cable is connected to the 2B FC loop switch in the master rack.
2. FC drive enclosure

Figure 5.16 shows the two 1A Fibre Channel loops and the expansion panels.

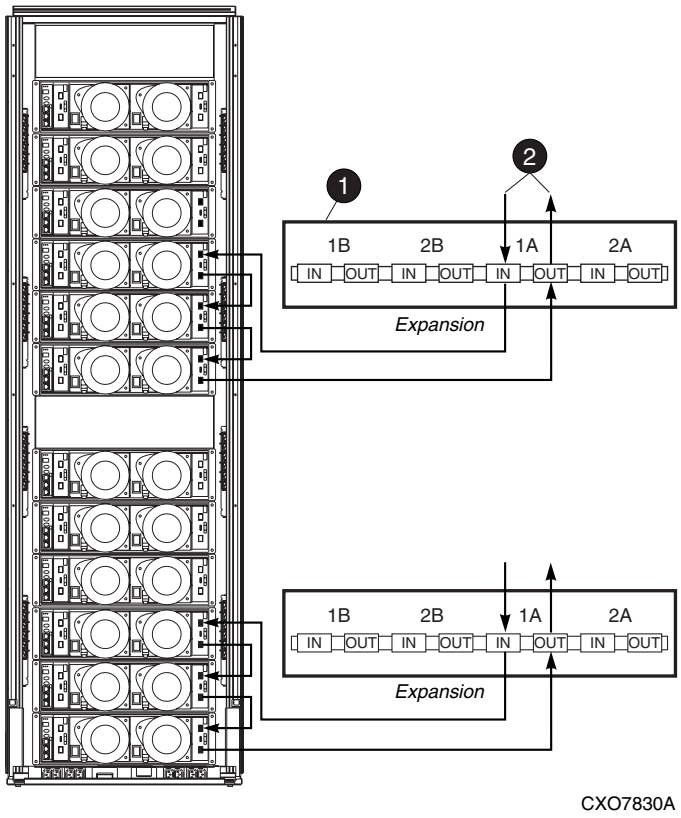


Figure 5.16. 0C6D + 6D configuration—Fibre Channel loop 1A with expansion panels

Callouts:

1. Expansion panel
2. 5-meter copper cables that connect to the master rack.

Figure 5.17 shows the two 1B Fibre Channel loops and the expansion panels.

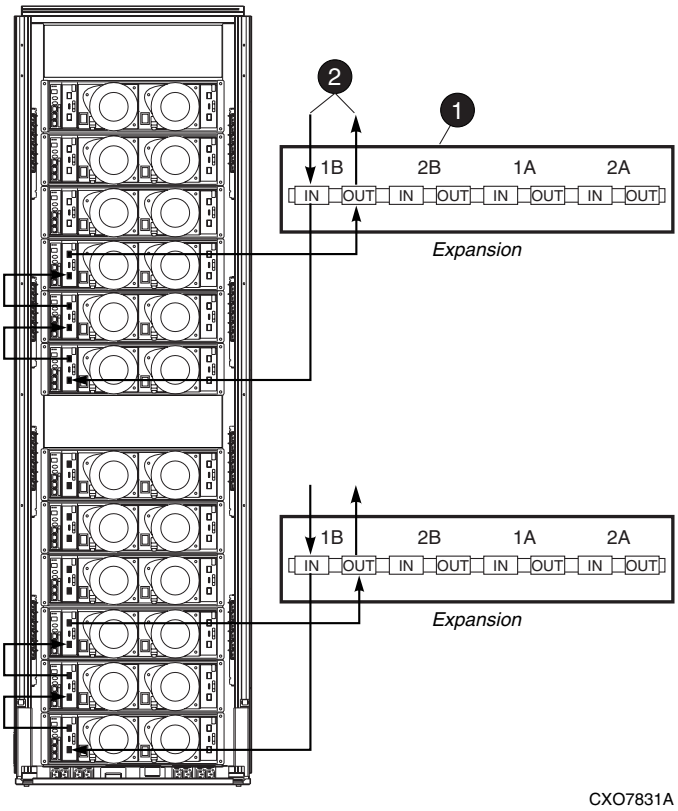


Figure 5.17. 0C6D + 6D configuration—Fibre Channel loop 1B with expansion panels

Callouts:

1. Expansion panel
2. 5-meter copper cables that connect to the master rack.

Figure 5.18 shows the two 2A Fibre Channel loops and the expansion panels.

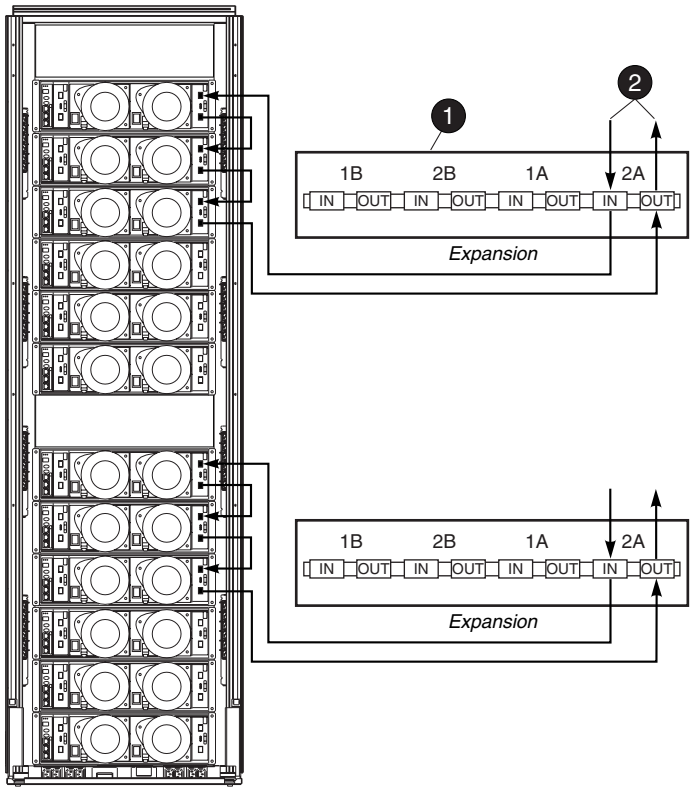


Figure 5.18. 0C6D + 6D configuration—Fibre Channel loop 2A with expansion panels

Callouts:

1. Expansion panel
2. 5-meter copper cables that connect to the master rack

Figure 5.19 shows the two 2B Fibre Channel loops and the expansion panels.

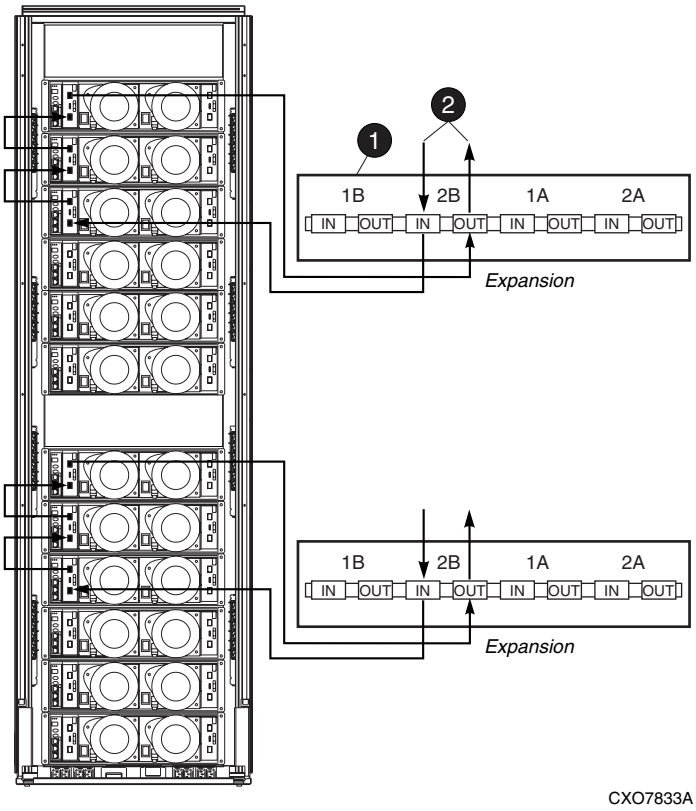


Figure 5.19. 0C6D + 6D configuration—Fibre Channel loop 2B with expansion panels

Callouts:

1. Expansion panel
2. 5-meter copper cables that connect to the master rack

Chapter 6. Enterprise Virtual Array 3000 Rack Expansion

This chapter summarizes how to add new FC drive enclosures to an Enterprise Virtual Array 3000 storage rack and describes the placement of the HSV100 controllers, FC drive enclosures, enclosure address bus junction boxes and cables, and copper cables.

This chapter contains the following sections:

Only HP authorized service representatives may expand the 2C2D configuration. The 2C2D configuration may be expanded by adding FC drive enclosures, cables, and enclosure address bus cables to the existing configuration.

The 2C2D rack can be expanded to the following:

- 2C3D (expands the 2C2D configuration to 42 disks)
- 2C4D (expands the 2C2D configuration to 56 disks)

Adding FC drive enclosures to a rack

An HP authorized service representative can add FC drive enclosures to a rack while the Enterprise Virtual Array 3000 is on or off. HP highly recommends that the Enterprise Virtual Array 3000 is turned off while adding FC drive enclosures to a rack. If the HP authorized service representative would like to add an FC drive enclosure to the rack with the power on, the service representative should take care to disconnect and connect one cable loop at a time.

Adding FC drive enclosures involves placing the FC drive enclosures in the rack, connecting the FC drive enclosures to the enclosure address bus and the power outlets, and correctly adding the FC drive enclosures to the cable loops.

Note

An HP authorized service representative must add the FC drive enclosures to the rack. Do not attempt to add an FC drive enclosure without first seeking guidance and assistance from an HP authorized service representative.

2C2D configuration

The 2C2D configuration contains two FC drive enclosures (28 disks). This configuration is shown in Figure 6.1.

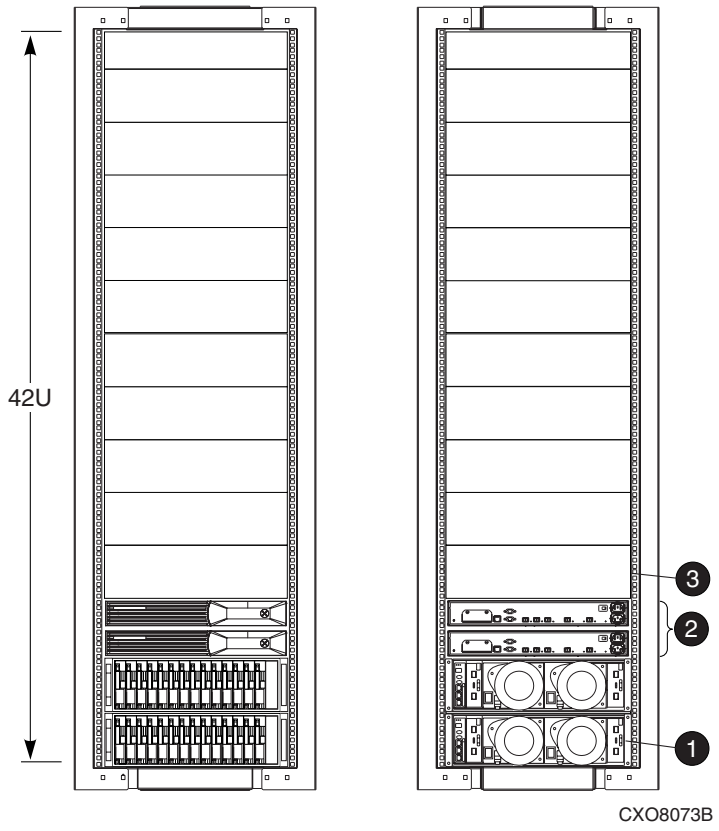


Figure 6.1. 2C2D configuration

Callouts:

1. FC drive enclosure

2. HSV100 controller pair 3U blank

2C3D configuration

The 2C3D configuration provides up to three FC drive enclosures (42 disks) and a maximum storage capacity of 6.1 TB in a single-rack configuration (Table 6.1).

Table 6.1. Maximum Storage Capacity for the 2C3D Configuration

Disk Size	Maximum Capacity
36.4 GB	1.5 TB
72.8 GB	3.1 TB
146 GB	6.1 TB

Note

This configuration is available only with assistance from an HP authorized service representative.

Enclosure address bus configuration

The 2C3D configuration contains three enclosure address junction boxes at 6U increments in the left rear rail of the rack. Each FC drive enclosure should be connected to an enclosure address bus junction box. The FC drive enclosures connect to each enclosure address bus junction box in pairs. The HSV controller pair connects to the enclosure address bus junction box with a Y cable. Figure 6.2 shows the enclosure address bus cable configuration for the 2C3D configuration.

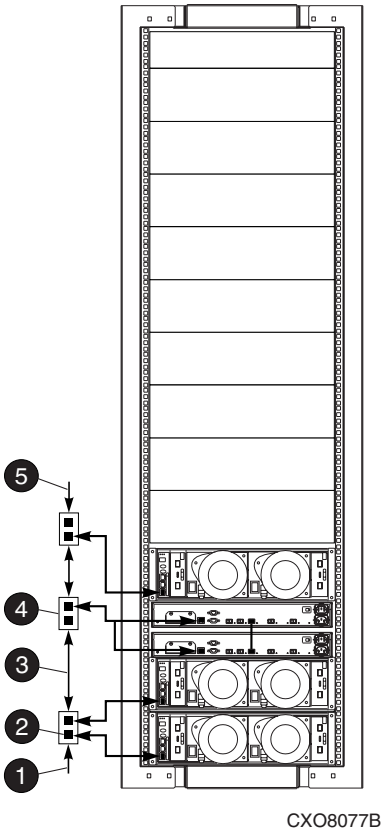


Figure 6.2. 2C3D configuration—enclosure address bus cables

Callouts:

1. Bottom terminator
2. Enclosure address 1
3. Enclosure address bus cable
4. Enclosure address bus junction box
5. Top terminator

Loop configurations

The 2C3D configuration contains two copper cable loops. A loop is formed when the FC drive enclosures and the HSV controller pair are connected by cables.

Table 6.2 provides the locations for the cable loops in a storage rack.

Table 6.2. Fibre Channel Loop Locations in Rack

Fibre Channel Loop	Location in Rack (viewed from rear)
1A	Lower right side
1B	Lower left side

Figure 6.3 shows loop 1A in the 2C3D configuration.

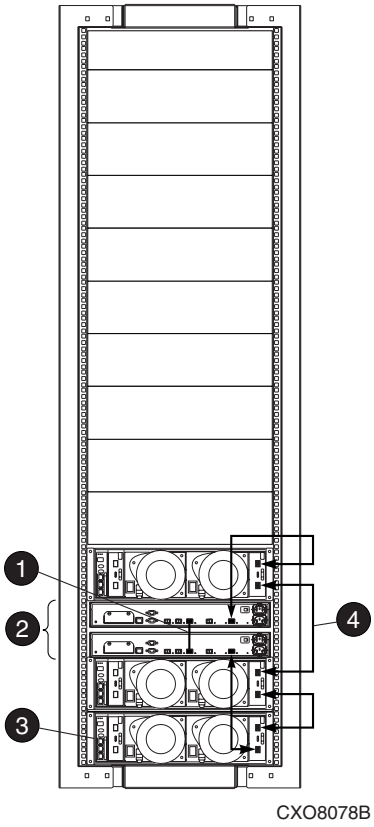


Figure 6.3. 2C3D configuration—loop 1A

Callouts:

1. Controller-to-controller mirror port cable
2. HSV100 controller pair
3. FC drive enclosure
4. Cable

Figure 6.4 shows loop 1B in the 2C3D configuration.

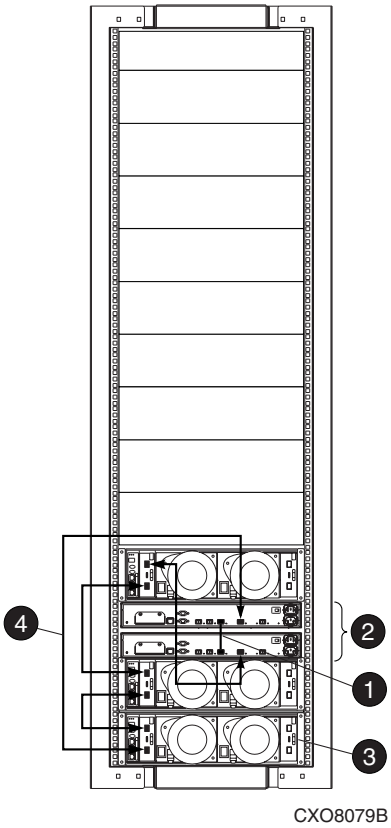


Figure 6.4. 2C3D configuration—loop 1B

Callouts:

1. Controller-to-controller mirror port cable
2. HSV100 controller pair
3. FC drive enclosure
4. Cable

2C4D configuration

The 2C4D configuration contains four FC drive enclosures (56 disks) in a single-rack configuration. The 2C4D provides a maximum of storage capacity of 8.2 TB (Table 6.3).

Table 6.3. Maximum Storage Capacity for the 2C3D Configuration

Disk Size	Maximum Capacity
36.4 GB	2.0 TB
72.8 GB	4.0 TB
146 GB	8.2 TB

Enclosure address bus configuration

The 2C4D configuration contains three enclosure address junction boxes at 6U increments in the left rear rail of the rack. Each drive enclosure should be connected to an enclosure address bus junction box. The drive enclosures connect to each enclosure address bus junction box in pairs. Figure 6.5 shows the enclosure address bus cable configuration for the 2C4D configuration.

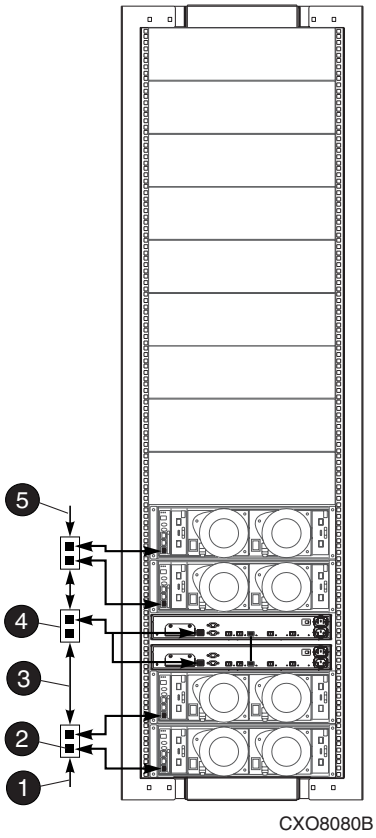


Figure 6.5. 2C4D configuration—enclosure address bus cables

Callouts:

1. Bottom terminator
2. Enclosure address 1
3. Enclosure address bus cable
4. Enclosure address bus junction box
5. Top terminator

Loop configurations

The 2C4D configuration contains two copper cable loops.

Figure 6.6 shows the loop 1A in the 2C4D configuration.

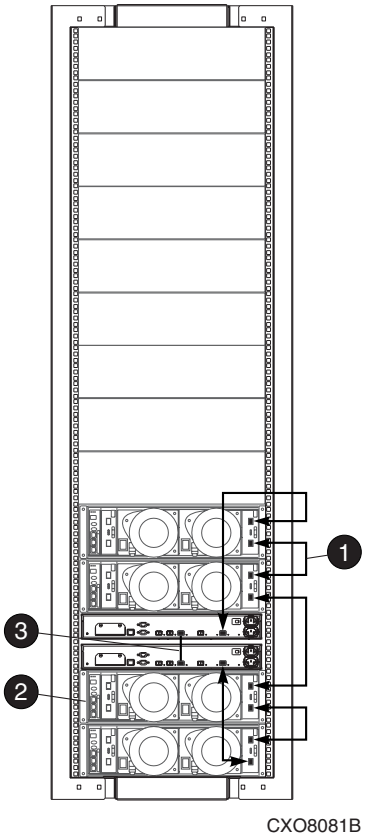


Figure 6.6. 2C4D configuration—loop 1A

Callouts:

1. Cable
2. FC drive enclosure
3. Controller-to-controller mirror port cable

Figure 6.7 shows loop 1B in the 2C4D configuration.

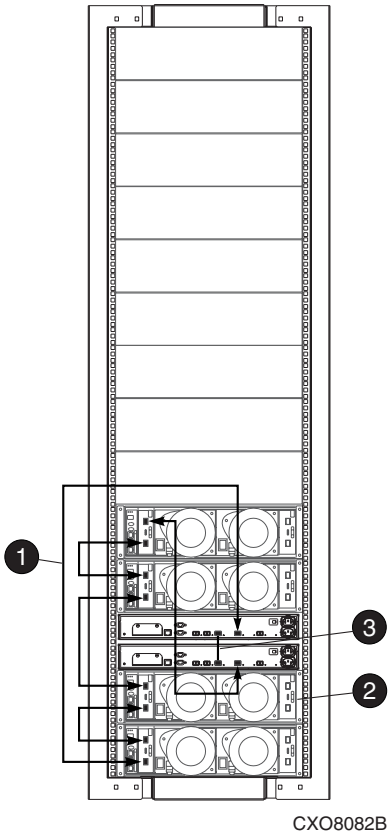


Figure 6.7. 2C4D configuration—loop 1B

Callouts:

1. Cable
2. FC drive enclosure
3. Controller-to-controller mirror port cable

Appendix A. Regulatory Notices and Specifications

This appendix includes regulatory notices and product specifications for the HP StorageWorks Enterprise Virtual Array.

The following topics are included:

Regulatory notices

Federal Communications Commission notice

Part 15 of the Federal Communications Commission (FCC) Rules and Regulations has established Radio Frequency (RF) emission limits to provide an interference-free radio frequency spectrum. Many electronic devices, including computers, generate RF energy incidental to their intended function and are, therefore, covered by these rules. These rules place computers and related peripheral devices into two classes, A and B, depending upon their intended installation. Class A devices are those that may reasonably be expected to be installed in a business or commercial environment. Class B devices are those that may reasonably be expected to be installed in a residential environment (for example, personal computers). The FCC requires devices in both classes to bear a label indicating the interference potential of the device as well as additional operating instructions for the user.

The rating label on the device shows the classification (A or B) of the equipment. Class B devices have an FCC logo or FCC ID on the label. Class A devices do not have an FCC logo or FCC ID on the label. After the class of the device is determined, refer to the corresponding statement in the following sections.

FCC class A certification

This equipment generates, uses, and may emit radio frequency energy. The equipment has been type tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC rules, which are designed to provide reasonable protection against such radio frequency interference.

Operation of this equipment in a residential area may cause interference, in which case the user at the user's own expense will be required to take whatever measures may be required to correct the interference.

Any modifications to this device—unless approved by the manufacturer—can void the user's authority to operate this equipment under Part 15 of the FCC rules.

Note

Additional information on the need to interconnect the device with shielded (data) cables or the need for special devices, such as ferrite beads on cables, is required if such means of interference suppression was used in the qualification test for the device. This information will vary from device to device and needs to be obtained from the HP EMC group.

Class A equipment

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at personal expense.

Class B equipment

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable

protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit that is different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or television technician for help.

Declaration of conformity for products marked with the FCC logo, United States only

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For questions regarding your product, refer to http://thenew.hp.com.

For questions regarding this FCC declaration, contact:

- Hewlett-Packard Company
  Product Regulations Manager
  3000 Hanover St.
  Palo Alto, CA 94304
- Or call 1-650-857-1501

To identify this product, refer to the part, series, or model number found on the product.

Modifications

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Hewlett-Packard Company may void the user's authority to operate the equipment.

Cables

Connections to this device must be made with shielded cables with metallic RFI/EMI connector hoods in order to maintain compliance with FCC Rules and Regulations.

Laser device

All Hewlett-Packard systems equipped with a laser device comply with safety standards, including International Electrotechnical Commission (IEC) 825. With specific regard to the laser, the equipment complies with laser product performance standards set by government agencies as a Class 1 laser product. The product does not emit hazardous light; the beam is totally enclosed during all modes of customer operation and maintenance.

Laser safety warnings

Heed the following warning:

Warning

To reduce the risk of exposure to hazardous radiation:

- Do not try to open the laser device enclosure. There are no user-serviceable components inside.
- Do not operate controls, make adjustments, or perform procedures to the laser device other than those specified herein.
- Allow only HP authorized service technicians to repair the laser device.

Compliance with CDRH regulations

The Center for Devices and Radiological Health (CDRH) of the U.S. Food and Drug Administration implemented regulations for laser products on August 2, 1976. These regulations apply to laser products manufactured from August 1, 1976. Compliance is mandatory for products marketed in the United States.

Certification and classification information

This product contains a laser internal to the Optical Link Module (OLM) for connection to the Fibre communications port.

In the USA, the OLM is certified as a Class 1 laser product conforming to the requirements contained in the Department of Health and Human Services (DHHS) regulation 21 CFR, Subchapter J. The certification is indicated by a label on the plastic OLM housing.

Outside the USA, the OLM is certified as a Class 1 laser product conforming to the requirements contained in IEC 825-1:1993 and EN 60825-1:1994, including Amendment 11:1996.

The OLM includes the following certifications:

- UL Recognized Component (USA)
- CSA Certified Component (Canada)
- TUV Certified Component (European Union)
- CB Certificate (Worldwide)

Canadien notice (avis Canadien)

Class A equipment

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Class B equipment

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

European Union notice

Products with the CE Marking comply with both the EMC Directive (89/336/EEC) and the Low Voltage Directive (73/23/EEC) issued by the Commission of the European Community.

Compliance with these directives implies conformity to the following European Norms (the equivalent international standards are in parenthesis):

- EN55022 (CISPR 22) - Electromagnetic Interference
- EN55024 (IEC61000-4-2, 3, 4, 5, 6, 8, 11) - Electromagnetic Immunity
- EN61000-3-2 (IEC61000-3-2) - Power Line Harmonics
- EN61000-3-3 (IEC61000-3-3) - Power Line Flicker
- EN60950 (IEC950) - Product Safety

Notice for France

DECLARATION D'INSTALLATION ET DE MISE EN EXPLOITATION d'un matériel de traitement de l'information (ATI), classé A en fonction des niveaux de perturbations radioélectriques émis, définis dans la norme européenne EN 55022 concernant la Compatibilité Electromagnétique.

Germany noise declaration

Schalldruckpegel Lp = 70 dB(A)

Am Arbeitsplatz (operator position)

Normaler Betrieb (normal operation)

Nach ISO 7779:1999 (Typprüfung)

Japanese notice

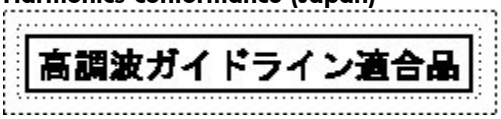
ご使用になっている装置にVCCIマークが付いていましたら、次の説明文をお読み下さい。

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスB情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。
取扱説明書に従って正しい取り扱いをして下さい。

VCCIマークが付いていない場合には、次の点にご注意下さい。

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です　この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

Harmonics conformance (Japan)



Taiwanese notice

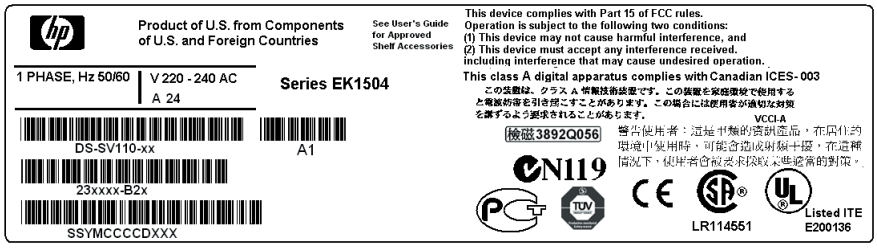
警告使用者:
這是甲類的資訊產品，在居住的
環境中使用時，可能會造成射頻
干擾，在這種情況下，使用者會
被要求採取某些適當的對策。

Country-specific certifications

HP tests electronic products for compliance with countryspecific regulatory requirements, as an individual item or as part of an assembly. The product label (see Figure A.1) specifies the regulations with which the product complies.

Note

Elements without an individual product certification label are qualified as part of the next higher assembly (for example, enclosure, rack, or tower).



CXO8157A

Figure A.1. Typical enclosure certification label

Note

The certification symbols on the label depend upon the certification level. For example, the FCC Class A certification symbol is not the same as the FCC Class B certification symbol.

Fibre Channel drive enclosure specifications

This appendix defines the physical, environmental, and power specifications of the Fibre Channel drive enclosure and the elements.

Physical specifications

This section describes the physical specifications of the drive enclosure and elements.

Warning

An assembled enclosure (all elements installed) weighs more than 29.5 kg (65 lb) and requires a minimum of two individuals to move.

Drive Enclosure Physical Specifications defines the dimensions and weights of the enclosure.

Table A.1. Drive Enclosure Physical Specifications

			Shipping	
	Empty	Installed	Carton	Carton and Pallet
NOTE: Metric dimensions are expressed in whole numbers. For example, 10.795 cm is expressed as 108 mm. Millimeter dimensions are always expressed in whole numbers.				
Height	131 mm (5.16 in)	131 mm (5.16 in)	641 mm (25.25 in)	768 mm (30.25 in)
Width	505 mm (19.875 in)	505 mm (19.875 in)	318 mm (12.5 in)	610 mm (24 in)
Depth	448 mm (17.625 in)	448 mm (17.625 in)	597 mm (23.5 in)	1016 mm (40 in)
Weight	10.9 kg (24 lb)	30.9 kg (68 lb)	43.6 kg (96 lb)	49 kg (108 lb)

Drive Enclosure Elements Physical Specifications defines the dimensions of the elements (that is, EMU, blowers, I/O module, drives, and power supply).

Table A.2. Drive Enclosure Elements Physical Specifications

Specification	Installed	Shipping Carton
NOTE: Dimensions are expressed in whole numbers. For example, 10.795 cm is expressed as 108 mm. Millimeter dimensions are always expressed in whole numbers.		
Environmental Monitoring Unit (EMU)		
Height	114 mm (4.5 in)	210 mm (8.25 in)
Width	241 mm (9.5 in)	330 mm (13.5 in)
Depth	35 mm (1.375 in)	108 mm (4.25 in)
Weight	0.6 kg (1.3 lb)	0.91 kg (2.0 lb)
Blower		
Height	140 mm (5.5 in)	191 mm (7.5 in)
Width	159 mm (6.25 in)	203 mm (8.0 in)
Depth	83 mm (3.25 in)	229 mm (9.0 in)
Weight	0.45 kg (1.0 lb)	0.91 kg (2.0 lb)
I/O Module		
Height	114 mm (4.5 in)	210 mm (8.25 in)
Width	41 mm (1.625 in)	108 mm (4.25 in)
Depth	241 mm (9.5 in)	330 mm (13.0 in)
Weight	0.59 kg (1.3 lb)	0.77 kg (1.7 lb)
Disk Drive		
Height	114 mm (4.5 in)	216 mm (8.5 in)
Width	26 mm (1.025 in)	114 mm (4.5 in)
Depth	241 mm (9.5 in)	330 mm (13.0 in)
Weight	0.59 kg (1.3 lb)	1.0 kg (2.3 lb)
Power Supply (without blower)		
Height	114 mm (4.5 in)	286 mm (11.25 in)
Width	159 mm (6.25 in)	330 mm (13.0 in)
Depth	241 mm (9.5 in)	419 mm (16.5 in)
Weight	1.82 kg (4.0 lb)	3.86 kg (8.5 lb)

Environmental specifications

To ensure optimum product operation, you must maintain the operational environmental specifications listed in Environmental Shipping or Short-Term Storage Specifications. The ambient temperature, that is the enclosure air intake or room temperature, is especially critical.

Table A.3. Environmental Shipping or Short-Term Storage Specifications

Ambient temperature: +10 °C to +35 °C (+50 °F to +95 °F) with an average rate of change of 1 °C/hour maximum and a step change of 3 °C or less. Maintaining the optimum ambient temperature within the specified range ensures that the internal operating temperatures support the drive manufacturer's MTBF specifications.
Relative humidity: 40% to 60% (noncondensing) with a step change of 10% or less (noncondensing)
Air quality: Not to exceed a maximum of 500,000 particles, 0.5 micron or larger, per cubic foot of air.
Heat dissipation: 1600 BTUs per hour

When shipping, or placing this product in short term storage, HP recommends maintaining the environmental conditions listed in Environmental Shipping or Short-Term Storage Specifications.

Table A.4. Environmental Shipping or Short-Term Storage Specifications

Ambient temperature: –40 °C to +66 °C (–40 °F to +151 °F)
Relative humidity: 10% to 80% (noncondensing)
Altitude: 15,240 m (50,000 ft)

Power specifications

The input voltage to the drive enclosure power supplies is a function of the country-specific input voltage to Enterprise storage system rack power distribution units (PDUs). Table A.5 defines the AC input power available to the drive enclosure power supplies.

Caution

The AC power distribution within a rack ensures a balanced to each PDA and reduces the possibility of an overload condition. Changing the cabling to or from a PDM could cause an overload condition.

Table A.5. Enterprise Storage System AC Input Line Voltages

Specification	Minimal	Nominal	Maximum
	60 Hz Service		
AC Line Voltage	57 Hz	60 Hz	63 Hz
AC Line Voltage—Japan	180 VAC	202 VAC	220 VAC
AC Line Voltage–North America	180 VAC	208 VAC	220 VAC
AC Line Voltage–Europe	208 VAC	240 VAC	254 VAC
	50 Hz Service		
AC Line Frequency	47 Hz	50 Hz	53 Hz
AC Line Voltage–Japan	180 VAC	202 VAC	220 VAC
AC Line Voltage–North America	190 VAC	220 VAC	235 VAC
AC Line Voltage–North America	200 VAC	230 VAC	244 VAC
AC Line Voltage–Europe	208 VAC	240 VAC	254 VAC

Table A.6 defines the AC input current and wattage to the drive enclosure power supplies.

Table A.6. AC Input Current and Wattage

Nominal		Maximum		
Input Voltage	Amps	Watts	Amps	Watts
60–Hz Input				
100 VAC–JBOD	4.35	436	6.41	641
208 VAC–North America	2.03	419	2.94	609
50–Hz Input				
120 VAC–JBOD	3.59	419	5.27	633
220 VAC–North America	1.92	418	2.78	608
230 VAC–North America	1.92	418	2.78	608
240 VAC–Europe	1.76	416	2.55	607

Table A.7. Output Voltage and Current Specifications

		Range	
Specification	Minimum	Nominal	Maximum
+5.1 VDC			
Initial Voltage Steady state current	+5.13 VDC 1.0 A	+5.18 VDC N/A	+5.23 VDC 26.0 A
+12.2 VDC (Disk Drive Voltage)			
Initial Voltage Steady state current	+12.13 VDC 1.0 A	+12.25 VDC N/A	+12.37 VDC 26.0 A
+12.5 VDC (Disk Drive Voltage)			
Initial Voltage Steady state current	+12.25 VDC 0.0 0A	+12.50 VDC N/A	+12.75 VDC 2.0 A

Table A.8. Dual Power Supply Configuration Power Specifications

Voltage	Current (A)	Power (W)
Maximum Continuous Current		
+5.1 VDC (with a minimum +12.2 VDC load of 0A) +12.2 VDC (with a minimum +5 VDC load of 4A) +12.5 VDC	26.0 A 28.0 A 2.0 A	132 W 342.0 W 25.0 W
	Total	499.0 W
Maximum Peak Current (Simultaneous Seek Activity)		
+5.1 VDC +12.2 VDC +12.5 VDC	26.0 A 43.0 A 2.0 A	132.0 W 524.0 W 25.0 W
	Total	681.0 W

Fibre Channel switch specifications

The Fibre Channel Switch requires a clean, dry environment for normal operation. Table A.9 lists the specifications for the Fibre Channel Switch.

Table A.9. Fibre Channel switch specifications

Specification	Description
Weight	Approximately 7.5 lbs.
Dimensions	8.50 x 1.57 x 16.00 inches (W x H x D) NOTE: The switch with extender is 21.66 in (depth).
Operating Temperature	0 °C to 40 °C for normal operation (ambient air temperature)
Storage Temperature	-40 °C to 80 °C noncondensing
Power	50 or 60 Hz 100–250 VAC 0.5–0.3 A

Controller specifications

This section defines the physical, power, and environmental specifications of the controller enclosure.

Physical specifications

Table A.10 defines the dimensions of the controller and replaceable units.

Table A.10. Physical Specifications

Specification	Installed	Shipping
NOTE: Metric dimensions are expressed in whole numbers. For example, 10.795 cm is expressed as 108 mm.		
Controller Enclosure		
Height Width Depth Weight	62 mm (2.45 in) 502 mm (19.75 in) 444 mm (17.49 in) 10.4 kg (23 lb)	267 mm (10.5 in) 762 mm (30 in) 762 mm (30 in) 12.7 kg (28 lb)
Cache Battery Assembly		
Height Width Depth Weight	57 mm (2.25 in) 184 mm (7.25 in) 83 mm (3.25 in) 1.3 kg (2.8 lb)	108 mm (4.25 in) 324 mm (12.75 in) 162 mm (6.375 in) 1.5 kg (3.4 lb)
Blower		
Height Width Depth Weight	55 mm (2.125 in) 116 mm (4.625 in) 105 mm (4.125 in) 0.4 kg (0.8 lb)	165 mm (6.5 in) 216 mm (8.5 in) 216 mm (8.5 in) 0.92 kg (2 lb)

Power specifications

Controller Power Supply AC Power Requirements and Controller Power Supply Output Specifications define the controller power supply input power requirements and output power specifications.

Table A.11. Controller Power Supply AC Power Requirements

AC Input Voltage			Frequency		
Minimum	Nominal	Maximum	Maximum	Minimum	Maximum
180 VAC	202 VAC	220 VAC	47 Hz	50 Hz	53 Hz
	208 VAC		57 Hz	60 Hz	63 Hz
208 VAC	240 VAC	254 VAC			

Controller Power Supply Output Specifications defines the output of the controller power supplies.

Table A.12. Controller Power Supply Output Specifications

Voltage Specification	Minimum	Nominal	Maximum
+3.3 VDC			
Output Voltage Steady state current Power	3.23 VDC	3.30 VDC	3.36 VDC 18 A 59.4W
+5.1 VDC			
Output Voltage Steady state current Power	4.80 VDC	5.00 VDC	5.25 VDC 5.0 A 25.5 W
		Total Current Total Power	24 A 105.6 W

1. +3.3 VDC steady state current requires a minimum 5.0-V load of 1 A.
2. Total power includes 14.0 watts for the internal blower.

AC Input Current and Wattage defines the AC input current and wattage to the controller power supplies.

Table A.13. AC Input Current and Wattage

Nominal			Maximum	
Input Voltage	Amps	Watts	Amps	Watts
60-Hz Input				
100 VAC	0.928	94	1.53	150
120 VAC	0.788	94	1.25	148
208 VAC	0.576	97	0.73	146
50–Hz Input				
220 VAC	0.616	102	0.69	146
240 VAC	0.573	100	0.64	147

Environmental specifications

There are no controller environmental specifications. See the the section called "Environmental Specifications" in Enterprise rack for this information.

Enterprise rack

Physical specifications

Warning

The weight of the drive enclosure with the elements installed always requires at least two individuals to move. HP recommends using a fork lift or a hand truck to move an enclosure in the shipping container.

Table A.14 through Table A.17 define the dimensions and weights of the Enterprise storage system racks.

Table A.14. Enterprise 42U Storage System Rack Physical Dimensions

	Height in / mm	Width in / mm	Depth in / mm	Max Wt lbs / kg
Enterprise 2C2D	78.75/2000.0	23.7/602	35.8/909	609/277
Enterprise 2C6D	78.75/2000.0	23.7/602	35.8/909	918/416
Enterprise 2C12D	78.75/2000.0	23.7/602	35.8/909	1350/612
Enterprise 0C6D	78.75/2000.0	23.7/602	35.8/909	818/371
Enterprise 0C12D	78.75/2000.0	23.7/602	35.8/909	1250/567

Table A.15. Enterprise 42U Storage System Rack Shipping Dimensions

	Height in / mm	Width in / mm	Depth in / mm	Max Wt lbs / kg
Enterprise 2C2D	85.38/2169	36.0/914	48.0/1220	802/365
Enterprise 2C6D	85.38/2169	36.0/914	48.0/1220	1111/504
Enterprise 2C12D	85.38/2169	36.0/914	48.0/1220	1543/700
Enterprise 0C6D	85.38/2169	36.0/914	48.0/1220	1011/459
Enterprise 0C12D	85.38/2169	36.0/914	48.0/1220	1443/654

Table A.16. Enterprise 41U Storage System Rack Physical Dimensions

	Height in / mm	Width in / mm	Depth in / mm	Max Wt lbs / kg
Enterprise 2C2D	78.75/2000.0	23.7/602	39.1/993	917/416
Enterprise 2C6D	78.75/2000.0	23.7/602	39.1/993	1349/612
Enterprise 2C12D	78.75/2000.0	23.7/602	39.1/993	817/371
Enterprise 0C6D	78.75/2000.0	23.7/602	39.1/993	1249/567

Table A.17. Enterprise 41U Storage System Rack Shipping Dimensions

	Height in / mm	Width in / mm	Depth in / mm	Max Wt lbs / kg
Enterprise 2C2D	85.38/2169	36.0/914	48.0/1220	1110/503
Enterprise 2C6D	85.38/2169	36.0/914	48.0/1220	1542/699
Enterprise 2C12D	85.38/2169	36.0/914	48.0/1220	1010/458
Enterprise 0C6D	85.38/2169	36.0/914	48.0/1220	1442/654

Environmental Specifications

To ensure optimum product operation, you must maintain the operational environmental specifications listed in Table A.18. The ambient temperature (the enclosure air intake or room temperature) is especially critical.

Table A.18. Environmental Operating Specifications

Ambient temperature: +10 °C to +35 °C (+50 °F to +95 °F) with an average rate of change of 1 °C/hour maximum and a step change of 3 °C or less. Maintaining the optimum ambient temperature within the specified range ensures that the internal operating temperatures support the drive manufacturer's MTBF specifications.
Relative humidity: 40% to 60% (noncondensing) with a step change of 10% or less (noncondensing).
Air quality: Not to exceed a maximum of 500,000 particles, 0.5 micron or larger, per cubic foot of air.
Heat dissipation: 12,708 BTUs per hour.

When shipping, or placing this product in short-term storage, HP recommends maintaining the environmental conditions listed in Table A.19.

Table A.19. Environmental Shipping or Short-Term Storage Specifications

Ambient temperature: –40 °C to +66 °C (–40 °F to +151 °F)
Relative humidity: 10% to 80% (noncondensing)
Altitude: 15,240 m (50,000 ft)

Power Specifications

Table A.20 defines the AC power specifications for the Enterprise storage system PDUs, PDMs, drive enclosure power supplies, and controller enclosure power supplies.

Table A.20. Enterprise Storage System AC Power Specifications

Nominal Input Voltage	Specifications
60-Hz Service	
202 VAC Voltage Range Power Receptacle	Japan 180—220 VAC, 57—63 Hz, 32 A, Single Phase 3-wire, 2-pole, IEC 309
208 VAC Voltage Range Power Receptacle	North America 180—220 VAC, 57—63 Hz, 30 A, Single Phase 3-wire, 2-pole, NEMA L6-30
240 VAC Voltage Range Power Receptacle	Europe 208—254 VAC, 57—63 Hz, 32 A, Single Phase 3-wire, 2-pole, IEC 309
50–Hz Service	
202 VAC Voltage Range Power Receptacle	Japan 180—220 VAC, 47—63 Hz, 32 A, Single Phase 3-wire, 2-pole, IEC 309
220 VAC Voltage Range Power Receptacle	North America 190—235 VAC, 47—63 Hz, 30 A, Single Phase 3-wire, 2-pole, NEMA L6-30
230 VAC Voltage Range Power Receptacle	North America 200—244 VAC, 47—63 Hz, 30 A, Single Phase 3-wire, 2-pole, NEMA L6-30
240 VAC Voltage Range Power Receptacle	Europe 208—254 VAC, 57—63 Hz, 32 A, Single Phase 3-wire, 2-pole, IEC 309

The power consumption of an Enterprise storage system is 3,724 W.

Glossary

This glossary defines terms used in this guide or related to this product and is not a comprehensive glossary of computer terms.

3U	A unit of measurement representing three “U” spaces. “U” spacing is used to designate panel or enclosure heights. Three “U” spaces is equivalent to 5.25 inches (133 mm). *See also* rack-mounting unit
AL_PA	Arbitrated Loop Physical Address. A 1–byte value the arbitrated loop topology uses to identify the loop ports. This value becomes the last byte of the address identifier for each public port of the loop.
ambient temperature	The air temperature in the area where a system is installed—also called intake temperature or room temperature.
ANSI	American National Standards Institute. A non-governmental organization that develops standards (such as SCSI I/O interface standards and Fibre Channel interface standards) used voluntarily by many manufacturers within the United States.
arbitrated loop	A Fibre Channel topology that links multiple ports (up to 126) together on a single shared simplex media. Transmissions can only occur between a single pair of nodes at any given time. Arbitration is the scheme that determines which node has control of the loop at any given moment.
arbitrated loop physical address	*See* AL_PA
arbitrated loop topology	*See* arbitrated loop.
array	All the disk drives in a storage system that are known to and under the control of a controller pair.
bail lock	Part of the power supply AC receptacle that engages the AC power cord connector to ensure that the cord cannot be accidentally disconnected.

baud	The maximum rate of signal state changes per second on a communication circuit. If each signal state change corresponds to a code bit, then the baud rate and the bit rate are the same. It is also possible for signal state changes to correspond to more than one code bit so the baud rate may be lower than the code bit rate.
bay	The physical location of an element, such as a drive, I/O module, EMU, or power supply in a drive enclosure. Each bay is numbered to define its location.
cabinet	An alternate term used for a rack.
cable assembly	A fiber optic cable that has connectors installed on one or both ends. General use of these cable assemblies includes the interconnection of multimode fiber optic cable assemblies with either LC or SC type connectors. • When there is a connector on only one end of the cable, the cable assembly is referred to as a pigtail. • When there is a connector on both ends of the cable, the cable assembly is referred to as a jumper.
client	A software program that uses the services of another software program. The Command View EVA client is a standard internet browser.
controller	A hardware/firmware device that manages communications between host systems and other devices. Controllers typically differ by the type of interface to the host and provide functions beyond those the devices support.
controller enclosure	A unit that holds one or more controllers, power supplies, blowers, cache batteries, transceivers, and connectors.
controller pair	Two interconnected controller modules which together control a disk array. A controller pair and the disk array together constitute a storage system.
CRU	Customer Replaceable Unit. A storage system element that a user can replace without using special tools or techniques, or special training.
customer replaceable unit	*See* CRU.
device ports	Controller pair device ports connected to the storage system's disk drive array through the FC-AL— also called a device-side port.
device-side ports	*See* device ports.
disk drive blank	A carrier that replaces a disk drive to control airflow within a drive enclosure whenever there is less than a full complement of storage devices.
disk drive	A carrier-mounted storage device supporting random access to fixed size blocks of data.
disk drive	A disk drive mounted in a drive enclosure that communicates with a controller pair through the device-side Fibre Channel loops. A disk drive is hardware with embedded software, as opposed to a virtual disk, which is constructed by the controllers. Only the controllers can communicate directly with the disks drives. The disk drives, in aggregate, are called the array and constitute the storage pool from which the controllers create virtual disks.

drive blank	*See* disk drive blank.
drive enclosure	A unit that holds storage system devices such as disk drives, power supplies, fans, I/O modules, transceivers or EMUs.
dual power supply configuration	*See* redundant power configuration.
dual-loop	A configuration where each drive is connected to a pair of controllers through two loops. These two Fibre Channel loops constitute a loop pair.
EIA	Electronic Industries Alliance. A standards organization specializing in the electrical and functional characteristics of interface equipment.
electromagnetic interference	*See* EMI.
electrostatic discharge	*See* ESD.
element	• In a drive enclosure, a device such as an EMU, power supply, disk, fan, or I/O module. The object can be controlled, interrogated, or described by the enclosure services process. • In the HP Open SAN Manager, a controllable object, such as the HP StorageWorks Enterprise Storage System.
EMI	Electromagnetic Interference. The impairment of a signal by an electromagnetic disturbance.
EMU	Environmental Monitoring Unit. An element which monitors the status of an enclosure, including the power, air temperature, and fan status. The EMU detects problems and displays and reports these conditions to a user and the controller. In some cases, the EMU implements corrective action.
enclosure	A unit used to hold various storage system devices such as disk drives, controllers, power supplies, fans, an EMU, or I/O modules.
enclosure address bus	An Enterprise Storage System bus that interconnects and identifies controller enclosures and drive enclosures by their physical location. Enclosures within a reporting group can exchange environmental data. This bus uses junction boxes and cables to assign enclosure numbers to each enclosure. Communications over this bus do not involve the FC-AL bus and are, therefore, classified as out-of-band communications.
Enclosure Services Interface	*See* ESI.
Enclosure Services Processor	*See* ESP.
Enterprise Virtual Array rack	A unit that holds controller enclosures, drive enclosures, power distribution supplies, and enclosure address buses that comprise an Enterprise Storage System solution—also called the Enterprise Storage System rack. *See also* rack.
Enterprise Virtual Array	The Enterprise Virtual Array is a product that consists of one or more storage systems. Each storage system consists of a pair of controllers and the disk drives they manage. A storage system within the Enterprise Virtual Array can be formally referred to as an Enterprise Storage System, or generically referred to as the storage system.

environmental monitoring unit	*See* EMU.
ESD	Electrostatic Discharge. The emission of a potentially harmful static electric voltage as a result of improper grounding.
ESI	Enclosure Services Interface. The SCSI-3 engineering services interface implementation developed for HP StorageWorks products. A bus that connects the EMU to the drives.
ESP	Enclosure Services Processor. An EMU that implements an enclosure's services process.
fabric	A Fibre Channel fabric switch or two or more interconnected Fibre Channel switches allowing data transmission.
fabric port	A port which is capable of supporting an attached arbitrated loop. This port on a loop will have the AL_PA hexadecimal address 00 (loop ID 7E), giving the fabric the highest priority access to the loop. A loop port is the gateway to the fabric for the node ports on a loop.
fan	The variable speed airflow device that cools an enclosure or element by forcing ambient air into an enclosure or element and forcing heated air out the other side.
FC HBA	Fibre Channel Host Bus Adapter. An interchangeable term for Fibre Channel adapter. *See also* FCA.
FCA	Fibre Channel Adapter. An adapter used to connect the host server to the fabric—also called a Host Bus Adapter (HBA) or a Fibre Channel Host Bus Adapter (FC HBA). *See also* FC HBA.
FC-AL	Fibre Channel Arbitrated Loop. The American National Standards Institute's (ANSI) document which specifies arbitrated loop topology operation.
FCC	Federal Communications Commission. The federal agency responsible for establishing standards and approving electronic devices within the United States.
FCP	Fibre Channel Protocol. The mapping of SCSI-3 operations to Fibre Channel.
fiber optic cable	A transmission medium designed to transmit digital signals in the form of pulses of light. Fiber optic cable is noted for its properties of electrical isolation and resistance to electrostatic contamination.
fiber optics	The technology where light is transmitted through glass or plastic (optical) threads (fibers) for data communication or signaling purposes.
fiber	The optical media used to implement Fibre Channel.
Fibre Channel adapter	*See* FCA.
Fibre Channel	A data transfer architecture designed for mass storage devices and other peripheral devices that require very high bandwidth.

Fibre	The international spelling that refers to the Fibre Channel standards for optical media.
field replaceable unit	*See* FRU.
frequency	The number of cycles that occur in one second expressed in Hertz (Hz). Thus, 1 Hz is equivalent to one cycle per second.
FRU	Field Replaceable Unit. A hardware element that can be replaced in the field. This type of replacement can require special training, tools, or techniques. Therefore, FRU procedures are usually performed only by an authorized service representative.
Gb	Gigabit. A measurement of the rate at which the transfer of bits of data occurs. Sometimes referred to as Gbps. Nominally, a Gb is a transfer rate of 1,000,000,000 (109) bits per second. For Fibre Channel transceivers or FC loops the Gb transfer rates are: • 1 Gb is a transmission rate of 1,062,500,000 bits per second. • 2 Gb is a transmission rate of 2,125,000,000 bits per second.
GB	Gigabyte. A unit of measurement defining either: • A data transfer rate. *See also* GBps. • A storage or memory capacity of 1,073,741,824 (230) bytes.
GBIC	Gigabit Interface Converter. *See also* transceiver.
Gbps	Gigabit per second. A measurement of the rate at which the transfer of bits of data occurs. Nominally, a Gb is a transfer rate of 1,000,000,000 (109) bits per second. *See also* Gb.
GBps	Gigabytes per second. A measurement of the rate at which the transfer of bytes of data occurs. A GBps is a transfer rate of 1,000,000,000 (109) bytes per second. *See also* GB.
Giga (G)	The notation to represent 109 or 1 billion (1,000,000,000).
gigabaud	An encoded bit transmission rate of one billion (109) bits per second.
gigabit per second	*See* Gbps.
gigabit	*See* Gb.
graphical user interface	*See* GUI.
GUI	Graphical User Interface. Software that displays the status of a storage system and allows its user to control the storage system.
HBA	*See* FCA.
Host Bus Adapter	*See* FCA.

host computer	*See* host.
host ports	A connection point to one or more hosts through a Fibre Channel fabric. A host is a computer that runs user applications and that uses (or can potentially use) one or more of the virtual disks that are created and presented by the controller pair.
host	A computer that runs user applications and uses (or can potentially use) one or more virtual disks created and presented by the controller pair.
host-side ports	*See* host ports.
hot-pluggable	A method of element replacement whereby the complete system remains operational during element removal or insertion. Replacement does not interrupt data transfers to other elements.
HP OpenView Storage Management Appliance software	A centralized, appliance-based monitoring and management interface that supports multiple applications, operating systems, hardware platforms, storage systems, tape libraries and SAN-related interconnect devices. It is included and resides on the HP OpenView Storage Management Appliance, a single aggregation point for data management.
HP StorageWorks Command View EVA	The graphical user interface (GUI) through which a user can control and monitor a storage system. The Command View EVA software can be installed on more than one management appliance in a fabric. Each installation of the Command View EVA software is a management agent. The client for the agent is a standard browser.
HP StorageWorks	The HP trademarked name used to describe the set of rack-mounted enclosures containing controllers, transceivers, I/O modules, EMUs, disk drives, cables, blowers, and power supplies used to design and configure a solution-specific storage system.
hub	A communications infrastructure device to which nodes on a multi-point bus or loop are physically connected. It is used to improve the manageability of cables.
I/O module	Input/Output module. The enclosure element that is the FC-AL interface to the host or controller. I/O modules are bus speed specific; either 1 Gb or 2 Gb.
in-band communication	The method of communication between the EMU and controller that utilizes the FC-AL bus. *See also* out-of-band communication.
input/output module	*See* I/O module.
intake temperature	*See* ambient temperature.
interface	A set of protocols used between components such as cables, connectors, and signal levels.
JBOD	Just a Bunch of Disks. A number of disks connected to one or more controllers.
just a bunch of disks	*See* JBOD.
KB	Kilobyte. A unit of measurement defining either storage or memory capacity.

	• For storage, a KB is a capacity of 1,000 (103) bytes of data. • For memory, a KB is a capacity of 1,024 (210) bytes of data.
K	Kilo. A scientific notation denoting a multiplier of one thousand (1,000).
laser	A device that amplifies light waves and concentrates them in a narrow, very intense beam.
LCD	Liquid Crystal Display. The indicator on a panel that is associated with an element. The LCD is usually located on the front of an element.
LED	Light Emitting Diode. A semiconductor diode, used in an electronic display, that emits light when a voltage is applied to it.
light emitting diode	*See* LED.
link	A connection between ports on Fibre Channel devices. The link is a full duplex connection to a fabric or a simplex connection between loop devices.
loop ID	Seven-bit values numbered contiguously from 0 to 126 decimal and represent the 127 valid AL_PA values on a loop (not all 256 hexadecimal values are allowed as AL_PA values per FC–AL).
loop pair	A Fibre Channel attachment between a controller and disk drives. Disk drives connect to controllers through paired Fibre Channel arbitrated loops. There are two loop pairs, designated loop pair 1 and loop pair 2. Each loop pair consists of two loops (called loop A and loop B) that operate independently during normal operation, but provide mutual backup in case one loop fails.
loop switch	A unit that acts as a central point of interconnection and establishes a fault-tolerant physical loop topology.
loop	*See* arbitrated loop.
management agent	The Command View EVA software that controls and monitors the Enterprise storage system. The software can exist on more than one management appliance in a fabric. Each installation of the Command View EVA software is a management agent.
MB	Megabtye. A term defining either: • A data transfer rate. *See also* MBps. • A measure of either storage or memory capacity of 1,048,576 (220) bytes.
Mb	Megabit. A term defining a data transfer rate. *See also* Mbps.
Mbps	Megabits per second. A measure of bandwidth or data transfers occurring at a rate of 1,000,000 (106) bits per second.
MBps	Megabytes per second. A measure of bandwidth or data transfers occurring at a rate of 1,000,000 (106) bytes per second.
Mega	A notation denoting a multiplier of 1 million (1,000,000).
Network Storage Controller	*See* NSC.

node port	A device port that can operate on the arbitrated loop topology.
NSC	Network Storage Controller. The controllers used by the Enterprise Storage System.
OCP	Operator Control Panel. The element that displays the controller's status using LEDs and an LCD. Information selection and data entry is controlled by the OCP pushbuttons.
operator control panel	*See* OCP.
out-of-band communication	Communication between an enclosure and reporting group elements that does not use the FC-AL bus, such as the enclosure address bus. *See also* in-band communication.
parity	A method of checking if binary numbers or characters are correct by counting the ONE bits. In odd parity, the total number of ONE bits must be odd; in even parity, the total number of ONE bits must be even. Parity information can be used to correct corrupted data.
PDM	Power Distribution Module. A thermal circuit breaker equipped power strip that distribute power from a PDU to Enterprise Storage System elements.
PDU	Power Distribution Unit. The rack device that distributes conditioned AC or DC power within a rack.
port	A Fibre Channel connector on a Fibre Channel device.
power distribution module	*See* PDM.
power distribution unit	*See* PDU.
power supply	An element that develops DC voltages for operating the storage system elements from either an AC or DC source.
rack	A floorstanding structure primarily designed for, and capable of, holding and supporting storage system equipment. All racks provide for the mounting of panels per Electronic Industries Alliance (EIA) Standard RS310C.
rack-mounting unit	A measurement for rack heights based upon a repeating hole pattern. It is expressed as "U" spacing or panel heights. Repeating hole patterns are spaced every 1.75 inches (44.45 mm) and based on EIA's Standard RS310C. For example, a 3U unit is 5.25inches (133.35 mm) high and a 4U unit is 7.0inches (177.79 mm) high.
redundancy	• Element Redundancy—The degree to which logical or physical elements are protected by having another element that can take over in case of failure. For example, each loop of a device-side loop pair normally work independently but can take over for the other in case of failure. • Data Redundancy—The level to which user data is protected. Redundancy is directly proportional to cost in terms of storage usage; the greater the level of data protection, the more storage space is required.
redundant power configuration	A capability of the Enterprise Storage System racks and enclosures to allow continuous system operation by preventing single points of power failure.

	• For a rack, two AC power sources and two power conditioning units distribute primary and redundant AC power to enclosure power supplies. • For a controller or drive enclosure, two power supplies ensure that the DC power is available even when there is a failure of one supply, one AC source, or one power conditioning unit. Implementing the redundant power configuration provides protection against the loss or corruption of data.
room temperature	*See* ambient temperature.
SCSI	• Small Computer System Interface. An American National Standards Institute (ANSI) interface that defines the physical and electrical parameters of a parallel I/O bus used to connect computers and a maximum of 16 bus elements. • The communication protocol used between a controller pair and the hosts. Specifically, the protocol is FC-AL or SCSI on a Fibre Channel. SCSI is the higher command-level protocol and Fibre Channel is the low-level transmission protocol. The controllers have full support for SCSI-2; additionally, they support some elements of SCSI-3.
SCSI-3 Enclosure Services	*See* SES.
SCSI-3	The ANSI standard that defines the operation and function of Fibre Channel systems.
SES	SCSI-3 Enclosures Services. Those services that establish the mechanical environment, electrical environment, and external indicators and controls for the proper operation and maintenance of devices within an enclosure.
small computer system interface	*See* SCSI.
solutions rack	A rack containing controller enclosures, drive enclosures, power distribution, enclosure address buses, and so forth that provides a specific solution such as the Enterprise storage system rack. *See also* rack.
storage system	The controllers, storage devices, enclosures, cables, and power supplies and their software.
switch	An electromechanical device that initiates an action or completes a circuit.
TBps	Terabytes per second. A data transfer rate of 1,000,000,000,000 (1012) bytes per second.
TB	Terabyte. A term defining either: • A data transfer rate. *See also* TBps. • A measure of either storage or memory capacity of 1,099,5111,627,776 (240) bytes.
terminator	Interconnected elements that form the ends of the transmission lines in the enclosure address bus.

topology	An interconnection scheme that allows multiple Fibre Channel ports to communicate. Point-to-point, arbitrated loop, and switched fabric are all Fibre Channel topologies.
transceiver	The device that converts electrical signals to optical signals at the point where the fiber cables connect to the FC elements such as hubs, controllers, or adapters— also called a Gigabit Interface Converter (GBIC).
units	*See* rack-mounting units.

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